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AN ANALYSIS OF THE PERFORMANCE OF DIFFERENT DEMOGRAPHIC GROUPS OF NAVY ENLISTED COHORTS

by

Thomas Haase

June 1995

Thesis Co-Advisors: Mark J. Eitelberg
Stephen Mehay

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AN ANALYSIS OF THE PERFORMANCE OF DIFFERENT DEMOGRAPHIC GROUPS OF NAVY ENLISTED COHORTS

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Submitted in partial fulfillment
of the requirements for the degree of

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ABSTRACT

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I. INTRODUCTION

A. OUTLINE OF THE PROBLEM

1. Discussion

Many countries have cut their annual military budgets in an effort to reduce public expenditures. This is also true for the United States. Using resources in the most efficient way is, and will always be, a key issue for military management. At the same time, management of military personnel must regularly reexamine manpower policy to optimize the quantity, mix, and quality of the force's personnel, to minimize related costs, and to adapt to sociodemographic changes in the population.

Current as well as future practice and policies need to be carefully and repeatedly evaluated with respect to their effect on military personnel. This thesis focuses on the effects of race and ethnicity on the promotion opportunities of enlisted personnel. The research is intended to assess two areas: 1.) promotion opportunities for different racial/ethnic groups; and 2.) the influence of equal opportunity programs on promotion outcomes.

2. Reason Why Situation Needs Attention

Management systems in government-run, non-profit organizations are <u>assumed</u> to select and promote fairly, that is, to discriminate solely on the basis of performance. But the problem on hand is the absence of an automatic control system to ensure fairness in promotions.

In fact, as Gorman (1993) writes: "[The] government may engage in much more unfair discrimination than private businesses. When business discriminates against individuals on any basis other than productivity, market mechanisms impose an inescapable penalty on profits . . . . While government practicing unfair discrimination face occasional losses only if their activities attract public disfavor, the losses incurred by businesses mount with each and every sale" (Gorman in Henderson, 1993, p. 470). Therefore, a method is necessary that allows the military personnel manager to ensure compliance with equal opportunity policies and the successful implementation of personnel policies.

B. OBJECTIVES OF THE RESEARCH

This work examines the effectiveness of the U.S. Navy's enlisted personnel development policies. The study is organized in two parts. First, regression analysis is utilized to assess longitudinal data from three cohorts of Navy enlisted personnel (groups entering the Navy in 1979, 1982, and 1985) and the potential of these data to predict performance. Also, the differential impact of racial/ethnical background on performance (while controlling for other sociodemographic variables) is addressed. Second, an attempt is made to address the short- and long-term influence of the Navy's equal opportunity programs on advancement rates for different racial/ethnic groups in the three cohorts.

C. ANALYTICAL RESOURCES

Existing studies of promotion are reviewed to understand the promotion process in general and specifically in the

Navy enlisted ranks. In addition, the literature is used as a basis for specifying the empirical promotion models.

The data for the thesis were provided by the Defense Manpower Data Center (DMDC) in Monterey, California. The data reflect the entire population of the enlisted force that entered the Navy in 1979, 1982, and 1985. Therefore, there have been no sampling considerations. The thesis uses regression analysis of these data to specify and estimate models of promotion for each of the three cohorts. Also, the differential impact of racial/ethnic status on performance, while controlling for other sociodemographic variables, is evaluated.

D. ORGANIZATION OF THE STUDY

A broad literature review in Chapter II establishes the background information about promotion opportunities for enlisted Navy personnel, the impact of racial/ethnic status on advancement, and the equal opportunity programs employed by the Navy. Chapter III describes the statistical model and the research methodology that has been utilized. The theoretical and empirical models are developed together with the findings of the preceding chapters. Chapter IV presents the results of the quantitative analysis. The chapter starts with the application of simple statistical procedures to describe the data sets and to compare different aspects across cohorts as well as across different attributes. The chapter concludes with a thorough examination of the characteristics and qualities of the models.

Chapter V presents conclusions derived from the multivariate analysis. In addition, it critiques the weaknesses and strengths of the data and the study and

assesses the influence of equal opportunity programs on promotion opportunities for minorities in the U.S. Navy.

II. LITERATURE REVIEW

A. PROMOTION OPPORTUNITIES OF ENLISTED PERSONNEL

Promotion is a fairly automatic procedure for enlisted personnel prior to the rank E-3, and it depends largely on the fulfillment of training requirements. Not everybody gets his or her training immediately. Some enlistees are assigned to units directly after boot camp. These young men and women are trained on the job and may attend "A" school later to qualify for assignment to a specific occupation. Because of this dual system, one cannot recognize solely from the rank of a person lower than E-4 whether he or she has qualified for an occupational specialty. Therefore, ranks E-1 through E-3 are excluded from the promotion analysis of this study.

Promotion to Petty Officer Third Class (E-4) depends on qualification for an occupational specialty. Table 1 refers to the rank structure, the rank titles, and minimum time-in-rank criteria for promotion. In addition, promotion criteria include the following:

> Criteria for advancement in all petty officer ranks include Navy-wide competitive written examinations, demonstrated proficiency in assigned duties within the occupational specialty, and a written periodic performance evaluation and recommendation of the commanding officer. All eligible personnel compete for advancement to fill existing vacancies in the total Navy allowance. In other words, advancement in a particular occupation specialty is contingent upon the Navy's requirement for personnel in that specialty as well as demonstrated performance by the candidate.
>
> Selection to [Chief Petty Officer] CPO, [Senior Chief Petty Officer] SCPO, and [Master Chief Petty Officer] MSPO is accomplished by a selection board convened annually by the Chief of Navy Personnel. Candidates who have successfully competed in the Navy-

wide examinations have their records placed before the board for consideration. Again, the total number selected in each rank and occupation specialty is based on total Navy vacancies. (Zucca, 1984, p. 5)

Table I Promotion Advancement Times by Enlisted Pay Grade and Title

Pay Grade	Title	Time in Service	Time in Rank
E-2	Seaman Apprentice	6 months	6 months
E-3	Seaman	6 months	6 months
E-4	Petty Officer Third Class	2 years	9 months
E-5	Petty Officer Second Class	3 years	1 year
E-6	Petty Officer First Class	7 years	3 years
E-7	Chief Petty Officer	10 years	3 years
E-8	Senior Chief Petty Officer	13 years	3 years
E-9	Master Chief Petty Officer	16 years	3 years

Source: Adapted from Zucca, 1984, pp. 4-6.

Cooke and Quester (1992) point out the importance of the correct selection of entry-level personnel in the military. Because the armed forces do not rely on lateral entry and incur significant up-front training costs, early identification of the successful future recruit is a key element for personnel management. The same argument holds for promotion practices.

Prior to the work of Cooke and Quester, research linked a history of unemployment, frequent job changes, a lack of job

experience, and the lack of a high school diploma to a higher probability of attrition. Cooke and Quester went one step further by establishing a relationship between entry level characteristics (such as age, Armed Forces Qualification Test [AFQT] score, high school graduation [HSDG], participation in the Delayed Entry Program [DEP], etc.) and early promotion, promotion to E-4, and retention.

They developed a "maximum likelihood" (logit) regression model, using data on a sample of male recruits with no prior service, who entered the Navy between 1978 and 1982. The results of the study indicate that possession of a high school diploma, a higher AFQT score, and entering through the DEP all indicate substantially better "success" in the Navy. This is true for all three models of "success," including completion of the first term of enlistment, promotion, and retention.

Horne (1987) explains the importance of the AFQT score for performance predictions:

> Individuals with higher AFQT scores are more likely to acquire the skills and knowledge necessary to perform their military assignments. The test scores measure trainability with some amount of measurement error, because true trainability is not observed. . . . The relationship of interest is therefore between AFQT score and the available performance data. (Horne, 1987, p.444)

Horne's final model describes the results on the Army's Skill Qualification Test (a substitute measure of performance) as a function of trainability, education, experience, training, gender, and race. Education is expressed as either holding a high school diploma (HSG) or not (NHSG) and is viewed as an indication of arithmetic, reading, writing, reasoning and other skills useful on the job. Experience is measured as the time spent in service, and training stands for the dummy variable "training in the same Military Occupational

Specialty (MOS)." The race variable distinguishes between white and nonwhite. As Horne (1987) writes:

> The variables statistically significant across equations are AFQT score and rank. The coefficients on AFQT score are quite similar across all MOS's, ranging from .15 to .20 . . . . Race is significant in two equations [i.e., MOSs], while high school diploma status is not significant in any. (Horne, 1987, p.451)

B. THE IMPACT OF RACIAL/ETHNIC STATUS

Butler (1976), in "Blacks and the Military," was one of the first authors to evaluate different promotion times between black and white enlistees. He was interested in possible unequal treatment of racial groups as an indication of potential institutional discrimination. His theory is that the Army, prior to 1976, was using specific overt and covert evaluation criteria, which led to a lower proportion of blacks in the higher enlisted ranks.

Prior studies and surveys revealed that blacks systematically needed more time to move up. Although other research suspected a linkage between the inequality in promotion time and racial/ethnic discrimination, Butler's analysis design, for the first time, controlled for demographic variables (in his case, education, AFQT score, and occupation type). Using "months in service to make current grade" as the dependent variable, Butler employed cross tabulations for the comparisons of the mean time-in-service to grade for both groups.

After evaluating the statistical results, Butler (1976) concludes: "Little support is given by the data presented for the argument that racial inequality is to be explained by the failure of Blacks to meet universalistic criteria." In

addition, he finds that whites are generally not more qualified; yet, it took blacks systematically more months in service to make grade. Butler ultimately finds that there is discrimination on the basis of race in the Army.

This statement is contrary to the findings of Cooke and Quester (1992), whose study indicates that black and Hispanic recruits, holding all other characteristics constant, have a slightly <u>higher</u> chance of completing their first term, of getting promoted, and of reenlisting. One possible reason why Butler's findings are different may relate to the timing of the studies. Cooke and Quester looked at groups during a time when "equal opportunity" was much more vigilant. On the other hand, the reason could also lie in the specific methodology Butler is using. The latter point is discussed in the next chapter.

Robinson and Prevette (1992), in "Disparities in Minority Promotion Rates: A Total Quality Approach, Fiscal Years 1987-1991," point out the existence of promotion rates that differ systematically, depending on the race of the enlisted person. The Navy E-7 promotion board is found especially "productive" in creating promotion differences between men of different races.

The authors employ control charts in their analysis and find:

> The U.S. Navy E-7 board has been the most significantly unequal board for minority promotion rates. . . . In both years [1991 and 1990], all minority males were promoted at below the board average. Black males were below the lower 3-sigma control limit in both years. White males were above the upper 3-sigma control limit in both years. (Robinson and Prevette, 1992, p. 10)

The observation that promotion rates for minorities differ from those for non-minorities is obvious. But, the attempt of Robinson and Prevette to indicate statistical significance may not have been successful. The control chart technique relies on a base value that serves as comparison to individual data. Unfortunately, the average advancement rate for all personnel who have been "in-zone" for promotion during a given fiscal year may not be appropriate.

Robinson and Prevette (1992) apparently do not take into account that the promotion process is everything but a random selection process. For example, the selection board members may try as hard as they wish, but there will still be individual or collective attitudes present during the process. In addition, depending on the specialty, there may be different advancement opportunities for each occupation. Furthermore, preferences of individuals may have brought individuals with either similar background characteristics and/or similar preferences into the same ratings. The list of examples could go on and on as to why one should not assume a random process as the basis for promotion rate comparisons. Particularly important is that selection is intended to be based on past, and predicted future, performance.Finally, selectivity bias is one of the strongest arguments against the method used by Robinson and Prevette. The reasons why individuals (select to) stay in the Navy to a particular promotion point may differ systematically by minority status.

The total quality approach may be one way of analyzing promotion processes, but the use of a control chart does not seem to be helpful, especially since it visualizes differences in outcome, not differences in promotion opportunities per se. The fairest promotion system may not necessarily mean that every person or every single demographic group will be

promoted at exactly the same rate.

C. EQUAL OPPORTUNITY PROGRAMS

The Navy's Affirmative Action (AA) goal is to ensure overall representativeness and to place more minority members in underrepresented ratings. The Secretary of the Navy has stated:

> Progress requires an absolute commitment to equal opportunity combined with aggressive command efforts to detect and eliminate all existence of discrimination. Prompt effective action to counter discrimination is the responsibility of every member of the Department of the Navy and is essential to the total success of our equal opportunity program. Race, color, religion, national origin, or gender are not considerations affecting the value or quality of life for Navy personnel.(Secretary of the Navy, 1989, p.1)

The Chief of Naval Operations has likewise stated:

> An environment of equal opportunity is essential to attaining and maintaining high state of morale, discipline, and military effectiveness. Command monitoring of internal practices . . . enable the commander, commanding officer, officer in charge or supervisor to take prompt positive action to counter discriminatory practices. (Chief of Naval Operations, 1989, p. 1)

These statements by Navy officials also point out the importance of a control system that monitors practices such as actual promotions in the enlisted force. This is where the present research comes in, by providing a concept for monitoring promotions and explaining possible discrepancies in advancement opportunities that are tied to ethnicity and/or race.

The absence of a comparable proportion of minority groups in the Navy, as well as on specific jobs, would be a first

indication for the absence of equal opportunities for these minorities. As Eitelberg (1988) puts it:

> One gauge for evaluating the "representativeness" of racial/ethnic groups in various jobs is the racial/ethnic composition of the entire enlisted force . . . . Perfect representation in any single job (or category of jobs) occurs when a group's proportion within that job matches its proportion in the entire enlisted force. . . . All things being equal (which they seldom if ever are, in any organizational setting), one would expect to find a random or representative distribution of persons from the enlisted force throughout the available jobs; consequently, the absence of perfect representation suggests that all things are not equal or that some intervening factors have influenced the outcomes of the job assignment [and promotion] process. (Eitelberg, 1988)

Assuming that promotion rates differ, depending on career paths or ratings, one cannot <u>directly</u> compare individuals or groups of enlistees from different specialties, unless the proportion of minorities in all specific ratings is the same as the overall distribution over all jobs or even in the entire population (Zucca and Gorman, 1986). This argument may be viewed as a "practicality" problem for this research. The next chapter draws on this problem to develop a correct methodological approach in assessing performance opportunities for different racial/ethnic groups.

III. METHODOLOGY

Affirmative action programs were established to promote a specific outcome that would not occur without some intervention. Therefore, a control mechanism is necessary that informs the personnel planner whether there is a need for more or less affirmative action. This study explores the possible effects of these programs and analyzes possible differential treatment in promotion based on minority status that cannot be explained by personal background characteristics (such as aptitude, schooling, training, occupational placement, and preferences, among others). In addition, this thesis seeks to develop a model that explains and predicts promotion outcomes.

Butler's (1976) research design limited the reliability of his results. Cross tabulations can be interpreted only when very few independent variables are introduced at the same time. In addition, one may be tempted to artificially categorize some independent variables in order to reduce the complexity of the model. Both actions may oversimplify the problem and lead to ambiguous results. Multiple regression, on the other hand, simultaneously considers more independent variables. This procedure helps to overcome the shortcomings of Butler's statistical approach.

Furthermore, observed differences in promotion rates by minority status may not be significant (in a statistical sense) once other factors are held constant. Different advancement rates will be due to more than random variation. Only a statistical model that can attribute statistical significance to a difference in promotion rates is able to measure the success and/or usefulness of affirmative action programs. Regression analysis is a statistical procedure that can produce the necessary information. The following chapters

draw on multiple regression analysis to explain systematic differences in promotion rates.

A. ESTIMATION TECHNIQUE AND MODEL

When evaluating performance indicators for their ability to predict successful performance, one needs to carefully select possible explanatory variables which theoretically might have an influence on the performance of an individual. Also, the correct functional form of the regression model must be determined. A squared explanatory variable, as for example age-squared or years-of-education-squared, might be mirroring real world dependencies better than the non-transformed age and education measures. This is discussed later in this chapter.

For the dependent variable there is the possibility to model the time someone needed to get promoted to a specific rank. Or, one may model the probability of being promoted to a specific rank. And, as a third variation, one may look into the probability of early promotion, say, earlier than the average time needed.

Considering a military career, the ultimate question is whether a person gets promoted or not. But, modeling the chance of getting promoted to a specific rank will not get the information about how well someone does, given that he or she made the cut. Therefore, the more defined model has to quantify quality differences due to differences in duration to a specific rank. When using time-to-promotion as a dependent variable, an OLS (ordinary least square) regression is to be considered superior to a Logit regression, because it will not oversimplify the data by squeezing them into a dichotomous

dependent variable. Again, one would lose valuable information by not considering the performance differences indicated by a specific promotion time versus a binary variable indicating being promoted faster than average (yes or no).

B. THE RELEVANT SAMPLE

The database used in this thesis is a file of entry cohorts for fiscal years 1979, 1982, and 1985. The file contains longitudinal data on enlisted personnel who entered the Navy during these fiscal years. The year 1979 represents one of the first years with sizable minority groups other than blacks. And, during this year, due to the AFQT misnorming incident, accessions represented a wider range of quality than normally found. Thus, there were accessions of persons with less than the minimum required score on the AFQT. The year 1985 is the most recent year that still gives enough longitudinal data with the remaining time span of seven years for the records. Fiscal 1982 was selected for study because it is the midpoint between 1979 and 1985 and provides a good basis of comparison.

Variables used in the analysis that are from the MEPCOM edit file are coded at the individual's point of entry into the military and are re-coded annually to the year 1992. Variables from the Active-Duty Master LOSS file are only coded for persons who separated during the time the cohort is tracked (through 1992). Persons who never separated during this time period have zero values for variables in the LOSS file. In summary, the cohort database contains background and entry data for the start year as well as additional data for the same persons for subsequent years, as long as they are in the Navy or up to 1992, whichever occurs first. Since these

data cover the entire accession population, the results of this work may automatically be viewed as the result for the population.

Appendix A shows the contents of the data files. Appendix C shows the variable names, the number of occurrences, the mean values, and the standard deviations, as well as the minimum and maximum values. These data were obtained from the MEPCOM edit file and the Active-Duty Master LOSS file.

The interested reader may also refer to Appendix B, which contains the SAS coding used to create the data file for analyzing the 1979 cohort. The coding for the cohorts 1982 and 1985 are very similar. All three sets are then merged into the pooled data set.

In addition, Appendix B displays the restrictions imposed upon the data. All missing values have been eliminated. Persons whose data suggests they had separated before they entered the system are excluded. Also, in order to "create" similar conditions concerning the quality and the background of entering recruits, persons who served a term or more before, and were reenlisting when they re-entered the Navy for a second time, are dropped from the data base.

All variables indicating different ethnic and/or racial characteristics are recoded to suit the regression environment. Since they are all of nominal character, they are transformed into dummy value variables stating the quality as being either there (= 1) or not there (= 0). This way, the statistical programs are not implying an ordinal or even proportional relationship between the different racial or ethnic groups. Actually, the recoding requires even to distinguish between the different cohorts, because the same

value for a specific variable may have different meanings from cohort to cohort.

The original data sets indicate the point in time of specific events (i.e., they state the date of the event). For example, someone's promotion to E-4 might have occurred on June 12th, 1983. This created some difficulties, since not all members of a cohort join on the same day. Therefore, the statistical program needs to be able to calculate the time span between date of entry into the Navy and the date of a specific event such as promotion to E-4. Ignoring that fact would have meant not to account for a time span of nearly 12 months (which is the difference between the earliest and the latest entry into a given cohort). The code treats all events relative to the entry date into the Navy (i.e., in number of months, after the accession date).

This is basically also true for the promotion time line, with the added difficulty that the original data set may have the same event (again, promotion to E-4 may serve as a good example) recorded several times. Since it often takes more than a year to get promoted to the next highest rank, all the years in between two succeeding promotion dates are coded with the date of the last promotion. The program needs to be able to distinguish between data that are repetitions and new information that is important for the analysis.

C. THE THEORETICAL MODEL

Since performance in itself is not measurable, one needs to find a criterion that enables the personnel planner to distinguish between different levels of performance. One possible criterion in the military environment may be the performance evaluation report, or a series of performance evaluation reports. Unfortunately, these documents may be biased and, to some degree, may also depend on the non-professional relationship between the evaluator and the person evaluated. Therefore, one needs to look for a performance indicator variable that is as independent of personal bias as possible.

In addition, a good performance evaluation in the early years of one's career may not necessarily be linked to outstanding future achievements. For example, one may have personal preferences that hinder the person from excellent performance on future jobs, although he or she may be capable of a high level of performance.

Both difficulties can be resolved if one chooses the time-in-service that one needs to be promoted to a specific rank as the dependent variable. This variable minimizes the personal bias of superiors, includes actual success on the job, and, at the same time, indicates the future performance level, given that the circumstances remain about the same.

The Navy promotion system is based on the availability of vacancies in the next higher rank, which means one needs to have a vacant billet in an occupation at the next higher rank for a given individual to be promoted. "Time-to-Rank" is an excellent measure to also account for the availability of billets in a given occupational hierarchy.

This thesis selects "Time-in-service to E-4," "Time-in-service to E-5," and "Time-in-service to E-6" as the dependent variables for the models. There is not much sense in selecting a variable of less than "Time-in-service to E-4" because, up to E-3, the promotion process is based on successful completion of training rather than individual contributions. In other words, promotion up to E-3 does not indicate personal excellence on the job. Because this paper is also interested in the differential effect of belonging to different ethnic and/or racial groups, it is not meaningful to employ statistical models with an independent variable covering time to E-7 or any higher rank. The limitation exists due to the small number of minorities in the higher ranks for the specific cohorts used here. Since significance testing procedures must have a minimum number of observations to be reliable, and this minimum number is not available for ranks E-7 and up, statistical results would not be reliable. They would probably be biased and possibly lead to misinterpretations.

AFQT score is considered an indication of trainability. Higher AFQT scores indicate that one will be able to succeed in a highly cognitive and demanding training program (Horne, 1987). A possible systematic difference for minorities in answering test questions that leads to biased results may exist. But, this research does examine these differences. Test theory is beyond the focus of this work and possible differences are considered random for all practical purposes.

Education has been identified as an excellent indication of a person's ability to make it through the first term of service. In this sense, the variable is intended to measure "stick-to-itiveness." This thesis codes the variable "Education" as years of education completed. The reason is

that the author attempts to avoid issues concerning the equality of nontraditional educational programs compared with those of the regular system. Since time in school symbolizes first, the willingness and ability of a person to commit, and second indicates the level of education, this coding contains more information and is preferred to a list of different diplomas or degrees.

To "catch" those who remained longer than average in school to achieve a specific educational level, a combination variable is created that considers not only the highest grade but also age at the time of entry. One would expect someone with a lower level of schooling to be able to apply for employment earlier than someone with a longer education time.

The length of the initial enlistment term may reflect a person's willingness to "commit" and/or the possible existence of personal career planning. On the other hand, an important decision about a longer period in the future of a young person may be done carelessly and without considering personal consequences. Also, initial enlistment term reflects the length of skill training - those with longer terms receive training in more skilled occupations. These effects need to be picked up by a model that tests and predicts success on the job.

The "Age" variable gives information about the maturity of the applicant as he or she enters the Navy. An older applicant may have more life experience and may offer additional qualities of value to the military. Higher age may be related to being a better supervisor and/or having stronger leadership qualities. Of course, a person who is a lot older than the average applicant may seek to enter the military because he or she has not been able to initiate a career or at

least a professional future in the civilian labor market. In this case the individual might be a long-term unemployed or somebody with a history of many job changes.

The "Gender" variable is important because women are a minority in the military. Furthermore, due to past legislative restrictions that prohibited women for serving in specific ratings (such as on combat ships), their chances of promotion have been different from those of men. This effect may even be extreme for women who also belong to a racial or ethnic minority.

Further, it is assumed that the family situation influences the performance of an enlisted member. That influence may be positive or negative, depending on how the family situation affects the individual's social and professional status. For example, being married with one or two children may indicate a person's willingness to take responsibilities, may show the ability to plan for the future (concerning job and family), and so on. At the same time, it may also indicate poor family planning. To be single is what one would expect from a 18-year-old person anyway. And, somebody with a large number of dependents may have trouble organizing his or her (private) life and also may have financial difficulties that would have a negative effect on job performance. Moonlighting is one example.

Finally, the variables indicating the race and/or the ethnic origin of persons have to be created. Table II shows the variable names in the first column as well as the frequencies for specific cohorts. Some frequencies were not available because the coding of the original files changed after the year 1979. Those are denoted as NA (not available)

Table II Numbers of Navy Enlisted Personnel, by Minority Status and Cohort Year

Minority	Cohort'79	Cohort'82	Cohort'85
Black	11,827	10,496	12,640
Hispanic	2,668	2,605	4,137
Mexican	1,219	1,349	1,905
Islander	NA	847	1,557
Puertorican	588	659	1,107
Filipino	349	462	761
Malayan	1,537	NA	NA
Orig. Hispanic	347	397	739
Aminre	NA	311	438
Native Indian	79	223	287
Latin American	NA	157	265
Cuban	56	43	121
Japanese	28	79	79
Asian	NA	17	85
Polynesian	NA	54	40
Korean	14	32	47
Chinese	11	25	39
Vietnamese	NA	11	40
Indian	NA	17	23
Micronesian	NA	5	33
Melanesian	NA	27	5
Eskimo	14	4	7
Asian American	19	NA	NA
Aleut	5	0	2
All Groups	18,761	17,820	24,357

Source: Derived from data provided by the Defense Manpower Data Canter.

in the table. Bold printed minority groups indicate the availability of data for all three cohorts. However, not all of those will be used in the empirical model, because some of these groups are so small that statistical testing is not possible with the necessary amount of reliability.

In addition, the author had to change variable names to combine variables with the same meaning but different names (for example, "Hispanic" and "White Spanish" as well as "Other

Hispanic" and "Spanish"). Each pair stands for the same group of persons and differed only because of the new coding after 1979. The newly-created variables "Hispanic" and "Spanish other" now account for members of these minorities throughout the three cohorts.

D. THE EMPIRICAL MODEL

The basic model identifies individuals by their cohort. This may be important, first, to capture the misnorming effect of the 1979 cohort (which led to accessions who had AFQT test scores below the minimum level) and, second, to pinpoint the general difference of belonging to a different year group with a different work environment. The author recognizes that for the year 1979 there will not be a clear distinction between whether the misnorming incident or other time-related factors are causing possible differences in promotion opportunities. Both factors may offset each other or may work in the same direction.

One's age at the time of entry into the Navy is limited to the range of 16 to 34 years. Observations with ages below 16 are considered as coding errors, and persons entering with an age higher than 34 are rare and possibly only due to exemptions, so that they are also excluded from the model. A variable that squares the age variable is used to enable the regression to identify diminishing returns for the oldest applicants.

The gender variable "Sex" is coded 1 for a female sailor. The regression results then directly indicate the change in promotion time for women. One would expect to find it easier for women to compete in the more junior ranks, because at the beginning of their career they may find more "suitable"

ratings. And "suitable" means the more traditional jobs in which women work in the civilian world. Although more and more jobs have been opened for women than in the past, the so-called "glass ceiling" is more likely to be found in senior positions, since it takes a while until changes from the bottom work through the hierarchy.

The "AFQT" variable reflects the percentile test scores attained by individuals on the Armed Forces Qualification Test. In the civilian labor market, one can find persons who are under- and overqualified. It is assumed that this is also true in the Armed Forces. An AFQT percentile score between 31 and 49 (also described as AFQT IIIb) is used as the base case. The variable "AFQT1" stands for everyone with a higher score; and the variable "AFQT4" captures a score range from 10 to 30 (or, in other words, from AFQT IVc to AFQT IVa).

In some instances, recruits get assigned a higher rank right away. One needs to remember that this is due to special programs, special skills, and other individual differences that are in high demand at the time. However, the higher initial rank is not due to prior service. Sailors with prior service are removed from the sample to keep the persons in the sample comparable. It remains to be seen whether special skills, prior training and/or highly-valued education that bring a higher initial rank can also assure faster promotion. It could also mean that those individuals are very competitive in the civilian labor market, that they are employed in a "niche," too small for the Navy to employ its own training, and therefore have a reduced chance for future promotions.

The Delayed Entry Program (DEP) allows individuals to postpone their entry into active duty for up to one year (Kearl, Nelson, 1992). Having been in the DEP may indicate

determination and planning for the future compared with a more instant idea of visiting the recruiting office right after graduation or in lieu of another civilian job. The DEP also gives recruits a chance to adjust to being in the military; and personnel attrition from the DEP sperates to "weed out" recruits who are likely to separate early from the active duty military.

Table III Coding Key for the "Education" Variable

Code Value	Highest Year of Education	Code Value	Highest Year of Education
1	Elementary (1-7)	7	College (1)
2	Elementary (8)	8	College (2)
3	High School (1)	9	College (3-4)
4	High School (2)	10	College Grad.
5	High School (3-4)	11	Masters Deg.
6	High School Grad	12	Doctorate Deg.

Table III illustrates the coding of the "Education" variable. The function of a squared variable in a regression model as a means to capture diminishing returns might also be useful for the "Education" variable and is therefore included in the final model.

One needs to carefully analyze the correlations between single variables, when considering success indicators for an entry level position. The relatively high age of an applicant may make him or her a preferred choice due to more life experience. But if the same person can only provide a low-level of education, then one might ask what he or she has done during all these years (Buddin, 1984). The variable

"Determination squared" captures the relation of age and education level as an indicator for success. Again, the variable is used in its squared form to recognize diminishing returns.

Recruits, to some degree and in accordance to training requirements, are allowed to choose the length of their first enlistment. Some may prefer a shorter obligation period than do others. And, this difference in action may also indicate differences in performance. Persons with an initial contract length of three years or less may not be as motivated as those with longer contracts; or, they may not be willing to take chances about their career. The so called "Short-Termers" may want to check out the employment conditions first, before taking longer obligations. This may be a wise move, or it may be more than appropriate carefulness. One should not forget that a good soldier has to weigh options and take risks for his or her personal well-being more than most other employees in the civilian world will ever have to do. In addition, longer obligations generally increase the cost of leaving, making a shorter first term more appealing (Mehay, 1994).

As many sailors say, the Navy partially serves as a family substitute. The sailor in his or her young twenties often is single or married without children. But, nowadays, an increasing number of enlisted personnel have a family of their own or at least dependents. These two groups are compared by the model: the single or married person without children versus the single or married person with children.

The next chapter discusses the statistical importance of all these variables discussed above and introduces the reader to the empirical results which may or may not coincide with the theoretical relationships for the different variables.

IV. STATISTICAL ANALYSIS AND RESULTS

This chapter introduces the results of simple statistical procedures and regression models. The purpose of the simple statistical procedures is to provide further insight into the data. In addition, the results provide a first check for the correct specification of the regression models, and they may further identify the form of specific variables used in the regressions.

The regression results are then discussed in two steps. First, the "Basic Models" are introduced and analyzed. With these models, the author analyzes the entire data set (the pooled 1979, 1982, and 1985 cohorts), at once, while controlling for any systematic differences related to specific cohorts using dummy variables. Second, to analyze how Equal Opportunity and Affirmative Action Programs have influenced promotion practices for the Navy's enlisted force, separate regression results are presented for each single cohort.

Also in this chapter, the author acknowledges specific difficulties related to the data structure, the size of single ethnic/racial minorities, possible bias issues, and more. These difficulties are pointed out to identify areas for possible future improvements of the regression models.

A. PRELIMINARY DATA ANALYSIS

1. Simple Statistics

a. Frequency Distributions

Table IV depicts the fact that many enlisted personnel are in pay grades E-2 and E-3 at the time of their entry into the Navy. This supports using promotion to higher rank as the variable to be forecasted. Persons with an entry grade higher than E-3 have been eliminated from the sample as being atypical for the regular enlisted career. Considering the overall size of the individual cohorts, as well as their combined size, female enlisted personnel and those who are

Table IV Number of New Enlisted Accessions by Cohort and Selected Variables

Variable	Cohort'79	Cohort'82	Cohort'85	Total
Male	66,480	68,437	71,874	**206,701**
E-1	55,660	56,058	65,524	**177,242**
E-2	3,841	2,905	3,751	**10,497**
E-3	15,501	17,291	12,211	**45,003**
Still Active (in 1992)	5,258	11,533	18,244	**39,035**
All	**75,002**	**76,254**	**81,486**	**232,742**

Source: Derived from data provided by the Defense Manpower Data Center.

still serving are sizeable subgroups that need to be addressed in the analysis later in this thesis.

The number of personnel in an enlisted entry cohort decreases as time progresses. In addition, it can not be assumed that cohorts with more recent entry dates are similar in size, due to different force strength requirements. The implication for this work, then, is that one should not compare absolute numbers (i.e., the size of a particular subgroup), but size relative to the entire population in question. This size might not have been affected at all, and the proportion of the subgroup may be constant over time. This needs to be addressed further in the analysis.

As Table V shows, the average entry age of enlisted personnel in the three cohorts is about 19.5 years. There was a slight increase over the three cohorts in question, as the average rose from 19.1 in the 1979 cohort to 19.7 in the more recent groups. The value of 6.5 for education (mean value for total sample) signifies an average above the level of a high school graduate with a diploma or corresponding General Educational Development (GED) equivalency certificate (which would be 6.0). This fact may not be surprising, since high school graduates are the target of recruiters. The extreme values of the variable "Highest Year of Education" become more important for the actual regression analysis.

Looking at the numbers for the average time in service (TINSVC) in months, it becomes obvious that the 1985 cohort differs from the others. The average number of months someone serves is down from almost 46 in 1979 to 38.5 for the 1985 group. But, one needs to be careful in interpreting this discrepancy. The difference may result from shorter contracts. It may also result from the fact that the 1985 cohort has had only eight years of service, since the dataset is updated only through the year 1992. So, one would expect the average time in service to increase further as time progresses. The same

Table V Number of Occurrences, Mean Values, and Standard Deviations for Selected Variables by Cohorts

Variable	**Cohort**	**N**	**Mean**	**Standard Deviation**
TTOE4	pooled	129,728	24.4	14.0
	1979	41,725	24.4	13.7
	1982	41,560	24.9	15.0
	1985	46,443	23.9	13.3
TTOE5	pooled	78,134	46.5	20.3
	1979	25,997	46.8	23.7
	1982	26,956	47.4	20.6
	1985	25,181	45.4	15.5
TTOE6	pooled	27,691	85.7	23.1
	1979	12,835	90.5	26.7
	1982	10,527	85.2	19.8
	1985	4,329	72.5	10.9
Entry Age	pooled	232,742	19.5	2.5
	1979	75,002	19.1	2.1
	1982	76,254	19.7	2.4
	1985	81,486	19.7	2.6
AFQT Score	pooled	232,742	55.3	22.2
	1979	75,002	51.7	23.7
	1982	76,254	56.0	21.6
	1985	81,486	58.0	20.7
TINSVC	pooled	93,707	43.2	28.7
	1979	65,744	45.9	33.0
	1982	64,721	45.0	28.7
	1985	63,242	38.5	22.8
Education	pooled	232,742	6.5	2.1
	1979	75,002	6.2	2.0
	1982	76,254	6.7	2.4
	1985	81,486	6.4	1.7

Source: Derived from data provided by the Defense Manpower Data Center.

Where: TTOE4 = Time in service to promotion to E-4
TTOE5 = Time in service to promotion to E-5
TTOE6 = Time in service to promotion to E-6
TINSVC = Time in service
(all in months)

argument holds for the 1982 cohort, which in 1992 is in its 11th year of being tracked. Since the three cohorts are in

different stages of maturity, one needs to be especially aware of the most recent cohort's limitations. Since it takes about seven years for a person to become an E-6, it would not be appropriate to model promotion to E-7 or higher, because members of the 1985 cohort are not yet eligible (in these data) for promotion to E-7 or higher, yet.

A person's level of education and AFQT score are indicators of one's qualifications to serve in the Navy. For the cohort groups, it can be seen in Table V that the average AFQT score increased from 51 to 58, and the standard deviation decreased. This means the Navy has been able to not only increase the quality of its personnel, on average, but also on the individual level. The variance of possible outcomes for the AFQT scores has narrowed considerably. It should also be noted that these scores have been corrected for the 1979 cohort to account for the AFQT misnorming. This might explain why the difference for the mean values and the standard deviations is so much larger for the 1979 cohort when compared with the other groups.

There is one overall trend concerning promotion to E-4, E-5, and E-6, as seen in Table V. Members of the 1985 cohort have been promoted considerably faster to each of these grades. The average time over all three cohorts for promotion to E-4 is 24 months, which coincides with the requirement of two years of service. The average time-in-service to Petty Officer Second Class (E-5) for these three cohorts is about ten months longer than the legal requirement of three years. And, for promotions to Petty Officer First Class (E-6), the average time again equals the requirement of seven years.

One needs to be careful in interpreting these data for the purpose of an analysis of promotion practices. The

above-mentioned mean times to promotion only account for those who made the cut, those who were promoted at all. Excluding everyone else would truncate the dataset considerably and would mean a preselection of a sample out of the entire population based on the underlying success factor "promotion to the rank in question."

Some argue that, because of this potential bias, only a "survival model" that evaluates the odds of surviving the system to specific points in time or promotions would be the correct form because it takes account of the entire population (Gilroy, Horne, and Smith, 1991). On the other hand, survival models are not able to distinguish between the more successful sailor who got promoted faster and the less successful one who just made it to the next higher rank. Therefore, the author believes that not considering different times-in-service to promotion will take away valuable information from the analysis.

The goal should be to minimize bias (i.e., to minimize excluded personnel from the database). This is accomplished by including within the model those who left the system, because they missed promotion just before reaching the rank in question. For example, persons who left the Navy as an E-3 are assigned a projected promotion time to E-4 that equals the total time in service. The author recognizes that these values are optimistic in nature, since not everybody would have been promoted on the day following the termination of service. Nevertheless, this projection should be closer to reality than excluding about 40 percent of the observations for promotion to E-4.

Second, by analyzing different models for different ranks, one leaves the possibility open that there might be

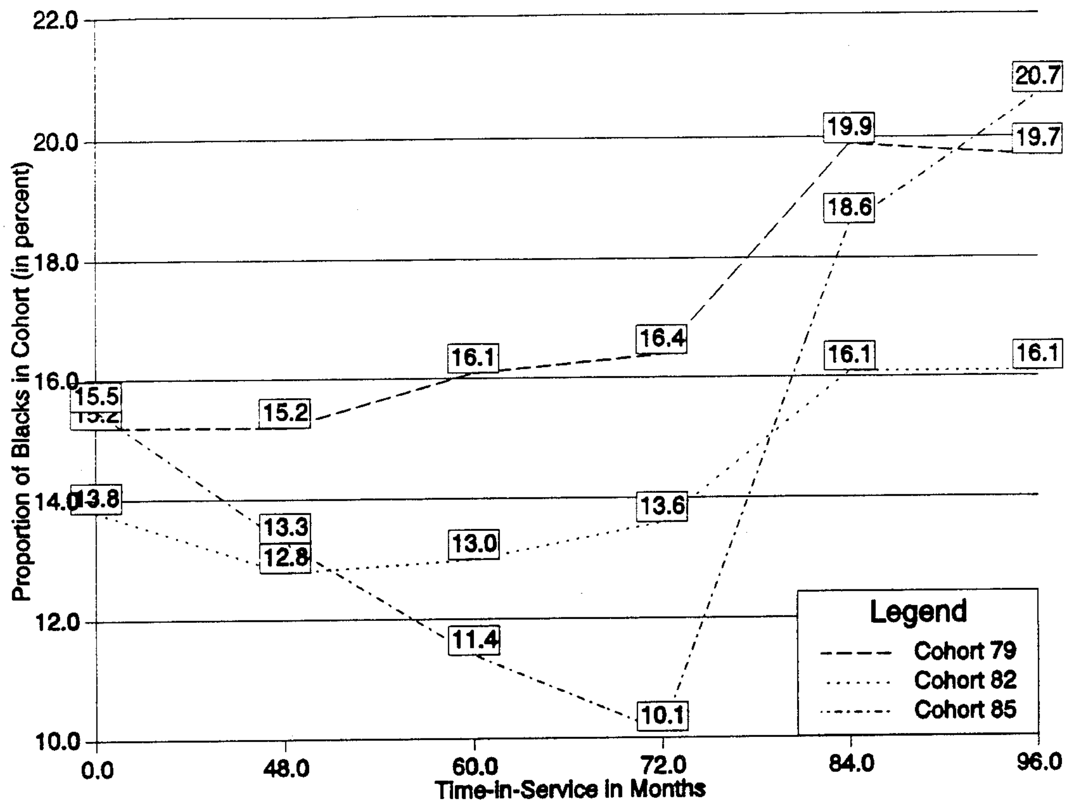
systematic differences between personnel, depending on when they left the system. More clearly, as appealing as it might be to avoid selection bias by modeling the entire population for, say, promotion to E-6, the model would not account for the fact that some enlistees may not want to be a Master Chief Petty Officer. And, further, it would not be appropriate to select identical promotion criteria for a recruit who wants to stay in the Navy for only four years. Therefore, and since there is no other motivation measure, it appears more appropriate to analyze persons who made it to a specific rank and those who theoretically would have been eligible to be promoted.

b. Time-in-service Comparisons

Figures 1 and 2 show the representation of two minority groups -- blacks and Mexican-Americans, respectively -- by cohort over time. There are some patterns that emerge: for blacks, the trend is increased representation over time. For all three cohorts, this may suggest that blacks are relatively successful in the Navy, on average. Again, this does not have to be the case. Indeed, without more information, one can only conclude that proportionately more blacks decide to stay in the Navy, given they are eligible to reenlist. Whether they are the more "successful" sailors would have to be evaluated by other means.

Although the above-mentioned arguments are the same for Mexican-Americans, the trend is different. The number of Mexican-American recruits increased over time. As seen in Figure 2, the proportion within the 1982 and 1985 cohorts does not change significantly (both cohorts have a slightly increased participation of Mexican-Americans by one tenth of a percent); and, within the 1985 cohort, Mexican-American

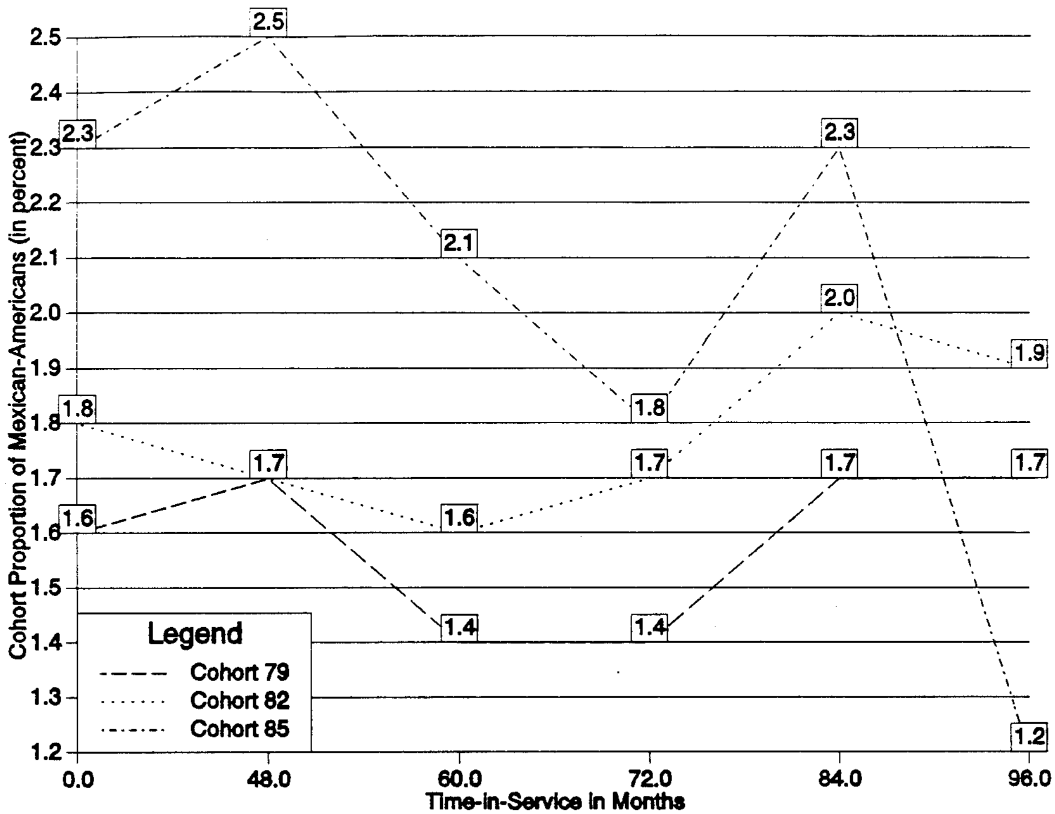
Figure 1 Blacks as a proportion of Navy Enlisted Personnel by Cohort Over Time (Months in service)



Source: Derived from data provided by the Defense Manpower Data Center.

participation drops by 50 percent in eight years (96 months). Figures 1 and 2 show quite different patterns and their interpretation needs to emphasize the need for separate analyses of different ethnic groups as long as sufficient numbers of data are available for any racial/ethnic minority.

Figure 2 Mexican-Americans as a Proportion of Navy Enlisted Personnel by Cohort Over Time (Months of Service)



Source: Derived from Data provided by the Defense Manpower Data Center.

2. Discussion

The simple statistics reveal important additional justification in the structure of the data. They provide further reasons for the specification of the final regression models. The regression models appear in detail in Appendix C. The first six models are discussed below.

First, the different cohorts, different promotion levels, and different ethnic and/or racial groups have to be treated separately, as previously explained. The cohort and minority

group identification are important explanatory variables within the models. The different promotion levels call for separate models. Three models are specified without distinguishing between different groups of racial or ethnic minorities. This is done because these models provide generalized results that can serve as a basis for comparing how well a specific minority group performed with respect to racial and/or ethnic minorities as a whole.

All other explanatory variables are thought to be determinants of one's productivity on the job. The importance of the variables have been discussed in previous chapters. This variable set enables the statistician to compare two persons or two groups of persons who are identical in all but one of the selected characteristics. This is one of the most important reasons why the multiple regression method is preferred to other statistical methods when analyzing possible differences in promotion for minorities.

B. RESULTS OF MULTIVARIATE MODELS

1. The Estimated Coefficients

The partial regression coefficients (or parameter estimates,) in Tables VI and VII express the change in the dependent variable for a one-unit change in one of the explanatory variables. Both changes are changes in the mean values, so they are not necessarily true for any given individual. All other variables are held constant or, as one may say, are controlled for (Gujarati, 1988, p. 169). These conditions prevail for all models used in the study.

Table VI Parameter Estimates for the Regression Models with Pooled Data, by Selected Variable

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
R-square	0.22	0.42	0.19	0.22	0.42	0.18
Dependent Variable	TTOE4	TTOE5	TTOE6	TTOE4	TTOE5	TTOE6
Fiscal 1979	0.4	-2.1	13.5	0.3	-2.1	13.5
Fiscal 1982	2.1	-0.7	9.8	2.1	-0.6	9.9
Entry Age (squared) / 100	0.5	-1.4	-0.4	0.5	-1.3	-0.3
Gender	0.3	0.8	3.2	0.4	0.8	3.2
AFQT 1	-4.6	-2.0	-2.2	-4.6	-2.0	-2.3
AFQT 4	1.9	3.7	3.5	1.9	3.7	3.6
DEP	-1.3	0.0	-0.6	-1.4	0.0	-0.6
Entry Grade	-6.3	2.0	-1.0	-6.2	2.0	-1.0
Education	-3.8	-1.7	-2.7	-3.8	-1.7	-2.6
Education (squared)	0.2	0.1	0.2	0.2	0.1	0.1
Determination (squared) / 100	-0.1	0.1	0.1	-0.1	0.1	0.1
Short Obligation	-1.0	1.5	0.5	-1.0	1.5	0.7
Single	-1.8	0.1	-0.5	-1.8	0.1	-0.5
Married	-2.4	-1.2	1.7	-2.4	-1.2	1.7
TTOE4		0.9	-0.2		0.9	-0.2
TTOE5			0.4			0.4
Minority				2.3	2.6	5.8
Black	2.7	3.0	6.8			
Hispanic	1.1	0.6	1.0			
Other Hispanic	0.3	1.7	-0.0			
Mexican-American	0.5	1.1	0.5			
Puerto Rican	1.7	1.7	2.5			
Philippine	0.2	4.0	11.6			
Native Indian	2.8	-1.7	-3.4			

Source: Derived from data provided by the Defense Manpower Data Center.

Note: Underlined regression coefficients are not significant at a 10 percent level. Intercept is omitted from table.

Thus, for example, a coefficient of 2.3 (or -2.3) means that, holding all other variables constant, an increase in the mean value per unit leads to a 2.3 months longer (or shorter) time in service to promotion.

a. *An Interpretation and Comparison*

The parameter estimates for the 1979 and 1985 dummy variables are positive for promotion to E-4, negative and again positive, respectively, for E-5 and E-6 promotions. These alternating advantages and disadvantages are partially due to the hierarchical manpower system in the Navy that promotes to fill vacancies. After a year with plenty of vacancies for a preceding cohort, it will take longer for personnel from following cohorts to get promoted. This is because vacancies will be less frequent for members of the following cohorts due to the time-in-rank minimum requirements for the next promotion of the incumbent. Also, but less obviously, differences for members of different cohorts may be due to the changed treatment of minorities over time. The answer to the question, "Over time, how did Equal Opportunity work for the promotion of racial/ethnic minorities in the Navy?," cannot be answered from these models because the models do not filter out the required information. To do this, separate regression models must be run for each separate cohort. (These results are attached in Appendix C, following model 6.) A tabular summary as well as a discussion of these models is presented at the end of this chapter.

For the basic models (displayed in Table VI) the variable entry age (squared) shows diminishing returns for promotion to E-4. The unsquared age could not be included as a variable in the model, since severe colinearity problems would have occurred together with the "Determination

(squared)" variable. However, the variable "Age squared" indicates that the entry age by itself may have no influence on later performance.

For women (the "Gender" variable measures differential promotion times for women), all six models show positive values for the "Gender" coefficients. Female sailors generally are promoted slower than their male counterparts, and the differences increase for promotion to higher pay grades. For E-4 promotion, the difference is smaller: on average, it takes women about two weeks longer than men to reach the grade. The difference increases to three weeks to promotion to E-5 and three months to promotion to E-6.

The regression models also suggest sailors with the highest AFQT score (Category I) are promoted quicker, on average, than those who score around the mean. And sailors with low scores on the test are promoted at the slowest rate. The range is largest for E-4 promotion. It seems that a person's score on the AFQT may be a good screening device. The data also suggest that there are other determinants at work with respect to promotion.

The data show that joining the Navy through the DEP is only an advantage for promotion to E-4. However, it appears that more life experience and a possibly greater interest in the Navy at the very beginning of one's service are not of permanent influence. During training and education, the level of life experience equals out. Further into the career, initial motivation may fade for some as others develop intrinsic reasons for staying in the Navy.

Persons who enter the Navy in grade E-2, and even more so for E-3, save about six or 12 months, respectively, on

the way to E-4. This is probably a systematic difference in treatment during the first term of enlistment. On the other hand, as Table VI shows, promotion to E-5 takes persons with entry grades E-2 and E-3 two and four months longer, respectively; and for promotion to E-6, again, both groups have a small advantage of one and two months, respectively. Obviously, this group competes on level ground from the second term on. And, there might be some skills that help them in their career. One might think about the earlier opportunities to use leadership skills in supervisory tasks.

The education variable is a good example of diminishing returns for increased number of years in school. Although the unsquared variable indicates two to four months less time in service to promotion, the squared variable has a negative sign, and thereby partially offsets the above-mentioned advantage. For example, from model one: persons with five years of schooling are promoted about four months faster than those with six years of education. This is counteracted by two additional months, resulting from the difference of five squared to six square multiplied with the parameter estimate for the squared schooling variable (0.204). This also means a decreased chance of earlier promotion for a person with eight or more years of schooling.

As seen in Table VI, the difference between three or four years of high school education on the one hand, and high school graduation with a diploma, on the other hand, can be expressed as an advantage of two months in promotion time to E-4. For persons with two years or more of college education, the diminishing returns are larger than the added benefit of the additional education.

The squared determination variable subtracts the years of education from the age of a recruit to measure the efficiency with which someone obtained his or her education. The variable picks up persons with an unusually high age for a lower level of education. Unfortunately, the variable cannot determine whether someone was employed or not, or whether the discrepancy is due to repeated grades. Then, the interpretation is that, with an increased difference between age and education, independent of what someone might have done during this time span, the likelihood of promotion to E-4 increases. At the same time, promotion time to E-5 and E-6 decreases. A straight-forward education, then, seems to decrease promotion time for career personnel.

The length of a person's initial term of enlistment is also found to offset time to promotion. A three-year (or less) term of enlistment reduces promotion time to E-4, but it increases time to E-5. Initially, the author thought that a shorter enlistment term gave the individual a chance to "check out" the system; it now appears more likely that the system rewards those who indicate an early willingness to stay for a longer time period. This makes sense from an economic point of view. Since training costs need to be recouped during "pay-back" tours, the short-termer will not get the same amount of training right away. After deciding to reenlist and get more training, these persons will still have a relative disadvantage since their career path has not been as straight-forward as those who made a longer-term commitment at the start.

Sailors who have dependents generally find faster promotion to E-4. This may reflect the possibly greater sense of responsibility among these recruits toward their family, but it may also show that there are facilities in place that

allow single parents to be successful on the job despite the fact that they have to care for dependents. Further into the career, the results become inconclusive for singles, while the coefficients for married persons with children have the opposite sign. For promotion to E-6, the average married father or mother will need more time according to the model. One's family may be seen to distract from service duties or limit one's options later in the career.

The models include the time in service it took a sailor to get promoted to E-4 when modeling time in service to E-5, and time-in-service to promotion to E-4 and E-5 as well, when modeling promotion to E-6. The time it took to reach a previous rank seems to be positively related to the promotion time of the current rank. For example, model 2 shows that every additional month for promotion to E-4 will result in nearly an additional month until the next promotion. This negative effect turns positive, when looking one level further. An increased time until promotion to E-4 will result in a faster promotion to E-6, while a longer time to be promoted to E-5 apparently slows one's promotion opportunities to E-6.

Minorities, in general, are promoted slower than their non-minority counterparts. For example, models 4 through 6 show that it takes minority members from two to six months longer to get promoted, all other factors being the same. Evaluated at the mean, a minority takes about 10 percent longer to get promoted to E-4, seven percent longer to E-5, and seven percent longer to E-6. Broken down into the selected seven minority groups of the first three models, only Native Indians are promoted faster than the majority to E-5 and E-6. But, the values are not significant at the 10 percent level,

due to the small numbers of Native Americans within the cohorts.

The statistical results for the models that are using the minority dummy variable are presented in Appendix C. Models 7 through 15, in Tables VII and VIII specifically evaluate differences in promotion times for minorities in general. (Models 7 through 9 cover time-in-service to E-4; models 10 to 12 do the same for E-5; and model 13 through 15 use time-in-service to E-6 as the dependent variable.) Models 16 through 24, in Tables VIII and IX are organized in the same fashion. The difference is that they evaluate promotion times for specific minorities (i.e., blacks, Hispanic-Americans, Mexican-Americans, all other Americans with Hispanic origin, Puerto Ricans, Filipino-Americans, and Native Americans).

On average, it takes a member of the 1979 cohort who is a racial or ethnic minority seven weeks longer for promotion to rank E-4 than someone from the majority. The differential increases for the 1982 and 1985 cohorts which differs from the expectation that these numbers should be decreasing if equal opportunity programs are effective. For someone from the latter-named two cohorts it takes an additional nine or ten weeks, respectively, to make E-4, should he or she belong to a racial or ethnic minority.

Table VII Regression Results for Time-in-Service to Promotion to E-4, E-5, and E-6 Models for Each Cohort, by Selected Variable

Variables	Model 7 Cohort 1979	Model 8 Cohort 1982	Model 9 Cohort 1985	Model 10 Cohort 1979	Model 11 Cohort 1982	Model 12 Cohort 1985
R-square	0.22	0.25	0.21	0.14	0.17	0.13
Dependent Variable	TTOE4	TTOE4	TTOE4	TTOE5	TTOE5	TTOE5
Entryage (squared) / 100	<u>0.4</u>	<u>-0.08</u>	1.7	<u>1.4</u>	<u>-0.6</u>	<u>0.04</u>
Gender	-2.5	<u>-0.3</u>	3.1	-1.1	2.4	5.0
AFQT 1	-2.8	-3.7	-6.7	-5.3	-6.9	-7.4
AFQT 4	2.1	2.2	2.2	-5.8	7.0	3.8
Entrygrade	-6.6	-7.2	-5.2	-5.4	-4.3	-1.5
Education	-4.4	-2.1	-5.3	-6.9	-3.8	-5.2
Education (squared)	0.2	0.1	0.3	0.4	0.2	0.3
Determination (squared) / 100	<u>-0.9</u>	<u>-0.2</u>	-2.8	-2.7	<u>-0.1</u>	<u>-0.1</u>
Short Obligation	-1.7	<u>0.1</u>	<u>0.4</u>	3.3	<u>1.1</u>	<u>-0.4</u>
Single	<u>-0.2</u>	-1.0	-2.6	<u>2.6</u>	<u>-0.6</u>	-2.0
Married	-1.6	-2.4	-2.4	-2.9	-2.7	-2.6
Minority	1.7	2.3	2.5	3.6	5.1	4.0

Source: Derived from Data provided by the Defense Manpower Data Center.
Note: Underlined regression coefficients are <u>not</u> significant at a 10 percent level. Intercept is omitted from table.

Table VIII Regression Results for Each of the Three Cohorts (Continued from Table VII), by Selected Variable

Variables	Model 13 Cohort 1979	Model 14 Cohort 1982	Model 15 Cohort 1985	Model 16 Cohort 1979	Model 17 Cohort 1982	Model 18 Cohort 1985
R-square	0.09	0.05	0.01	0.22	0.25	0.21
Dependent Variable	TTOE6	TTOE6	TTOE6	TTOE4	TTOE4	TTOE4
Entryage (squared) / 100	-3.0	<u>-0.3</u>	-0.3	<u>0.4</u>	<u>-0.06</u>	1.7
Gender	2.6	5.0	2.6	-2.5	<u>-0.3</u>	3.1
AFQT 1	-5.2	-4.4	1.7	-2.8	-3.7	-6.7
AFQT 4	5.8	2.4	-1.7	2.1	2.1	2.2
Entrygrade	-2.9	-1.1	0.8	-6.6	-7.3	-5.3
Education	-3.9	-4.7	<u>1.3</u>	-4.4	-2.2	-5.3
Education (squared)	0.3	0.2	<u>-0.0</u>	0.2	<u>0.1</u>	0.3
Determination (squared) / 100	5.0	<u>0.3</u>	3.6	<u>-0.8</u>	<u>-0.2</u>	-2.7
Short Obligation	<u>1.0</u>	<u>-3.0</u>	<u>2.6</u>	-1.7	0.1	<u>0.4</u>
Single	<u>2.2</u>	<u>-1.6</u>	<u>1.8</u>	<u>-0.3</u>	-1.1	-2.7
Married	<u>-1.7</u>	1.6	<u>-0.1</u>	-1.6	-2.4	-2.4
Minority	9.0	6.8	1.8			
Black				2.2	2.7	2.8
Hispanic				<u>0.4</u>	<u>0.4</u>	2.3
Other Hispanic				<u>-0.2</u>	<u>1.5</u>	<u>-0.9</u>
Mexican-American				<u>-0.0</u>	<u>0.9</u>	<u>-0.1</u>
Puerto Rican				<u>0.8</u>	<u>1.9</u>	<u>1.0</u>
Philippine				-1.7	<u>-0.3</u>	1.2
Native Indian				4.5	3.2	1.9

Source: Derived from data provided by the Defense Manpower Data Center.

Note: Underlined regression coefficients are <u>not</u> significant at a 10 percent level. Intercept is omitted from table.

So far, the interpretation for the "minority" variable was based on highly significant values (at the 10 percent level) and would have been significant even far below the selected alpha value (significance level). Since the Navy's Equal Opportunity and Affirmative Action programs concerning race and ethnic origin (versus gender) refer to racial and/or ethnic minorities as a whole, the above-mentioned results can be interpreted as providing a generalized answer to the research question. Still, it is interesting to see how fast particular racial/ethnic minorities have been promoted over the years based on their entry cohort.

First, it should be noted that not all of the results for the different regression runs are significant. In the following discussion, the author includes only results that are significant at the 10-percent level. All data for blacks are highly significant, which is not surprising as they are the largest minority subgroup (see Table II). As a result, the promotion times for blacks contribute heavily to the results of the "Minority" variable. Further, the coefficients of the "Black" variable follow the same patterns as the ones for the "Minority" variable; so, the same interpretations as above hold. The reader may view model 16 and following ones (see Tables VIII and IX). The actual values for additional promotion times vary only slightly. Exceptions to the "rule" are as follows. With respect to E-4, Native Indians experience a relatively faster time to promotion for each of the three cohorts, going from three months to two months to one month. This result contradicts the general findings from above.

Filipino-Americans were promoted to E-5 faster in the 1982 cohort (4.4 months) than in the 1979 cohort (4.8 months); but, they then slipped back to 5 months for the most

Table IX Regression Results for Each of the Three Cohorts (Continued from Table VII and VIII), by Selected Variable

Variables	Model 19 Cohort 1979	Model 20 Cohort 1982	Model 21 Cohort 1985	Model 22 Cohort 1979	Model 23 Cohort 1982	Model 24 Cohort 1985
R-square	0.14	0.17	0.13	0.09	0.05	0.01
Dependent Variable	TTOE5	TTOE5	TTOE5	TTOE6	TTOE6	TTOE6
Entryage (squared)/ 100	1.4	-0.6	0.04	-3.0	-0.4	-2.7
Gender	-1.1	2.4	5.0	2.6	5.0	2.6
AFQT 1	-5.3	-6.9	-7.3	-5.2	-4.4	1.9
AFQT 4	5.7	7.1	3.9	5.6	2.4	-1.6
Entrygrade	-5.4	-4.3	-1.6	-2.9	-1.0	0.8
Education	-7.0	-3.8	-5.1	-4.1	-4.8	1.3
Education (squared)	0.4	0.2	0.3	0.3	0.3	-0.0
Determination (squared) / 100	-2.7	-0.1	-1.0	4.6	0.4	3.6
Short Obligation	3.2	1.0	-0.4	0.7	-3.2	2.7
Single	2.5	-0.7	-2.0	2.2	-1.6	1.9
Married	-2.8	-2.7	-2.6	-1.6	1.7	-0.0
Black	4.2	5.5	4.3	10.1	7.6	2.3
Hispanic	1.5	1.3	1.6	2.2	10.2	2.4
Other Hispanic	2.7	3.3	0.7	7.5	-9.2	-3.6
Mexican-American	0.5	3.1	1.6	2.1	-8.0	-2.9
Puerto Rican	2.9	3.5	2.1	6.2	-7.0	-0.0
Philippine	4.8	4.4	5.0	19.1	10.2	8.3
Native Indian	-4.5	3.4	0.6	-6.0	0.3	-7.0

Source: Derived from data provided by the Defense Manpower Data Center.

Note: Underlined regression coefficients are not significant at a 10 percent level. Intercept is omitted from table.

recent cohort. This particular minority is the sixth largest racial/ethnic group, and these results imply that the parity has not been achieved in promotion to E-5 for this group.

With respect to E-6, Filipino-Americans exhibited a slower promotion time by a whopping 19 months in the 1979 cohort (which may be related to a specific personnel management policy and /or occupational placements). This is the highest number in all regression models concerning additional time-in-service of any racial/ethnic minority awaiting promotion to any of the examined ranks. The differential in time to promotion declines in the 1982 and 1985 cohorts by 10 and eight months, respectively. This, then, is still a difference of about three-quarters of a year on average.

Next, the significance of the different coefficients is discussed, before some conclusions are drawn from the promotion numbers for minorities.

b. *The Significance of the Coefficients*

Most coefficients are highly significant at the 10 percent level. There are certain notable exemptions here, such as Native Americans (mentioned above). For these and other special cases (the underlined values for the parameter estimates in Table VI), above discussed relationships cannot be relied on.

Starting with model 4, the interested reader may view the values in the column "Prob > |T|" (Appendix C gives the actual values), which inform about the statistical significance of the results. All variables for model 4 are significant at the 10 percent level. As one runs model 5 (time

in service to E-5, which occurs later during the career) DEP membership as well as being single with dependents lose their unambiguous influence on promotion. At the E-6 level, age, determination, and duration of the first term no longer hold explanatory value since they, too, are no longer significant at the required level.

The adjusted R-squares (as shown in Appendix C) are measures that filter out the fact that an increased number of explanatory variables in most cases will increase the R-square value, thereby artificially improving the goodness-of-fit of the model. Since the difference between the R-squared values and the corresponding adjusted R-squared value still is very small, and using the same set of variables makes comparisons easier, these nonsignificant variables are not taken out of

the final models 1 through 6. However, for the remaining models, the DEP variable had to be excluded, since the coefficients turn into constants for this variable. Further meaning of the R-square values are explained below.

C. MODEL CHARACTERISTICS

1. Validity

Validity characterizes the degree of confidence in the model's inferences with the real world or, in other words, that the model's results conform to reality. One indicator for the degree of validity is the R-squared value shown at the top of each printout in Appendix C. Another expression for R-square is "Multiple coefficient of determination," meaning the proportion of the variation in the dependent variable that can be explained by variation in the explanatory variables.

The R-squared values range from 18 to 42 percent for the six basic models, and indicate a high degree of validity, given the database consists of pooled data, which is a combination of time series and cross sectional data. Even more important may be that the original model's (model 4) coefficients are <u>all</u> significant at the 10 percent level, which in itself stands for a high level of validity for the model.

2. Relevancy

Whether the model is relevant is the question of whether it addresses directly the issue at hand. Looking back, the model with its subsets can be utilized to analyze the 1979, 1982, and 1985 Navy enlisted personnel cohort data. At the

same time, it is a powerful tool that has the qualities to predict performance as measured by the time to promotion to E-4, E-5, and E-6. Also, it shows the differential impact of racial/ethnic background on performance while controlling for other sociodemographic variables. In summary, the model meets the first set of research objectives, as stated in Chapter I.

3. Problem Areas

a. *The Unknown*

Smith, Sylwester, and Villa (in Gilroy, Horne, and Smith, 1991) do not find indications for discrimination based on the racial/ethnic status of U.S. Army personnel. Their study looks at cohort data from 1977 to 1984, divided into three equal-sized groups. Although they control for the fiscal year of accession, minority status, gender, number of dependents, years of education, AFQT score, prior service, and occupation, their model does not reveal inequalities in promotion time for minorities.

The difference in the findings between Smith, et al. and this thesis may be due to several factors. First, their database is different -- namely, the Army instead the Navy. Second, they predict the values for each explanatory variable for those who separated before one or two ranks below the one in question for modeling promotion time (assuming specific distributions for each variable). And, third, their set of explanatory variables (model specification) differs from this thesis.

It may not be possible to pinpoint all reasons for the different findings. However, the search for possible reasons helps to illuminate some common problems for this type

of analysis: it may very well be that there are systematic differences between the way the Army and the Navy handle promotions. However, the Smith, Sylwester, and Villa model can only be as good as its prediction for all the variable values of personnel who separated before promotion (80 percent of all variable values for promotion to E-6 are predicted and weigh that much more in the actual regression compared to actual data). Whether the assumptions used to create specifically-shaped distributions for those values are correct, remains to be proven.

Finally, this thesis chooses a richer set of explanatory variables then most other methods used to model promotion times. This difference may be responsible for different outcomes. And, although a (statistical) model should always be as simple as possible, there is no guarantee that the variable set is the one that simulates the real world best, or that important explanatory variables have not been omitted.

b. Data Issues

Including prior service members in the model may lead to bias. As Smith, Sylwester, and Villa (in Gilroy, Horne, and Smith, 1991) recognize:

> Prior-service soldiers have faster promotion times to grades E-5 and E-6. There are two related explanations for this result. First, prior-service soldiers typically return to the Army at a lower grade than their grade at separation and, therefore, have already demonstrated the skills required for that grade. Second, given the financial cost associated with an interrupted military career, it is likely that prior-service soldiers may be more motivated than the average soldier (Gilroy, Horne, and Smith,1991,p. 141).

This statement may not be the only interpretation of the underlying statistical results. Gilroy, Horne, and Smith also could have concluded that there are problems with the chosen database. It may also be problematic that entry grades from E-4 and higher do not seem to be excluded from the database. Based on the reasons developed in the methodology, this thesis pursued a different strategy by eliminating these questionable data.

c. Small Samples

The overall sample size never created a problem for this analysis. However, the small numbers for some racial/ethnic minorities at accession (and further reduction in their numbers over time) may have created a problem. Only the variables for blacks and racial/ethnic minorities as a whole yielded reliable and highly significant results. For the other racial/ethnic groups in the model not all results were conclusive.

d. Biases

This thesis as well as the work of Smith, Sylwester, and Villa (in Gilroy, Horne, and Smith, 1991) both control for different accession years. As stated elsewhere:

> The fiscal year of accession variables are included to measure any differences in promotion times due to macro factors, such as changes in the manpower requirements at each grade, deceleration of promotions in response to budget pressure, or differences in accession cohort size (Gilroy, Horne, and Smith, 1991, p. 141).

The difference in methodology is that this thesis, in a second step, analyzes the data for each cohort separately. The author believes this is necessary to identify

possibly discriminatory behavior that may have systematically varied over time. Those differences (as they are observed with the help of models 7 through 24) are not observed in the model used by Smith, Sylwester, and Villa, because that portion of discrimination will be attributed to fiscal year differences.

One additional, undetected bias may lie in the treatment of different occupations and/or occupational groups as explanatory variables. Most authors agree that one should control for differences in promotion time based on occupation, since promotion in the Navy is based on vacancies by occupation. This is a commonly accepted argument since it is known that self-selection leads to nonrepresentative distributions of minorities across occupations. However, selecting each rating as a dummy variable is not realistic considering the small size of some minority groups, so pooling of occupations is often undertaken. This creates another problem, because pooling of several occupational specialties (as well as the ensuing results) may then be arbitrary. Also, the influence of specific ratings on promotion time may not be the same over time and may be different depending on the enlisted rank. In addition, affirmative action programs more and more have targeted equal representation in the distribution of racial/ethnic groups across occupational specialties (Barnhill, 1991). All of these reasons convinced the author to select time-in-service to the two preceding grades of the one in question. This variable picks up systematic differences due to many factors, including occupational specialty, and allows for differences depending on rank simultaneously.

The next chapter summarizes the above discussed results and draws conclusions from the statistics.

V. SUMMARY AND CONCLUSIONS

A. SUMMARY

Projections of the racial/ethnic distribution of the nation's youth through the year 2000 indicate an increased share of minorities eligible for enlistment in one of the military services (Eitelberg and Mehay, 1994). An effective military has to have manpower development policies in place that ensure equal opportunities for racial/ethnic minorities.

This thesis offers an example of how multiple regression analysis can be used to monitor fairness in promotion practices and policies. The literature review focused on the development of the most useful research methodology for this thesis (which was found to be multiple regression analysis) as well as possible model specifications. The final empirical models were discussed in Chapter III, followed by the presentation of the statistical results.

The regression results of this thesis suggest that the racial/ethnic status of a Navy enlisted person accounts for a statistically significant difference in promotion time. Or, as Butler (1976) concludes for the data he analyzed: there is seemingly unequal treatment of racial groups concerning promotion times.

An enlisted person belonging to a racial/ethnic minority, on average, is promoted to either E-4, E-5, or E-6 (all other variables held constant) at a slower rate than members of the majority. Using multiple regression analysis, instead of Butler's (1976) cross-tabulation methodology, the findings in this thesis still tend to replicate his results : "Little

support is given . . . for the argument that racial inequality is to be explained by the failure . . . to meet universalistic criteria".

Further, this thesis analyzed promotion times to E-4, E-5, and E-6 for seven specific minorities. The results for blacks are most reliable, due to the consistently high number of blacks for any of the three cohorts and the three ranks in question. Black sailors tend to have slower times to promotion to the ranks examined here which coincides with the findings for racial/ethnic minorities in general (since blacks are the largest minority group). The results for the other six racial/ethnic minorities are not always reliable, and in some instances show opposite results (higher performance and earlier promotion, such as for Native Indians).

The control variables for the cohort's fiscal year, gender, AFQT group, entry grade, education, education squared, married, time to the two previous ranks are highly significant in the six basic models. Fiscal 1979 and 1982 cohort members are promoted faster to E-4, slower to E-5, and faster to E-6. Women, on average, are promoted at slower rates to any of these three grades (longest to E-6). A high AFQT score speeds up promotion, whereas low AFQT scores slow promotion (especially to higher grades). Together, the education and the education squared variables show the value of obtaining a higher level of education and diminishing returns to education. A married person with children seems to perform better in the more junior ranks but worse in the more senior ones. The time it takes to get promoted to E-4 seems to be positively related to time to promotion to E-5, but negatively related to time-to-promotion to E-6.

B. STRENGTHS AND WEAKNESSES OF STUDY AND MODEL

One limitation of this study is the small numbers of racial/ethnic minority members, especially in the higher ranks. This is the reason that the multiple regression analysis often shows insignificant regression coefficients. Also, choosing the cohort 1985 and analyzing promotion to E-6 may have truncated the data base, since there may be more persons in the 1985 cohort who, in 1992, are still waiting and eligible for promotion to E-6. This problem poses a dilemma: one either cannot analyze more recent cohort data or is limited to the more junior ranks. One way to overcome this limitation would be to update the database (the data used here follow the cohort through 1992) to include 1993 and 1994 data.

Further research should account for possible systematic differences relating to the occupation of a person. Time in the two previous ranks works as an approximation for these occupational differences; but, the author acknowledges that one should also conduct different analyses for each occupation or occupational group. Again, such research would probably be limited to larger racial/ethnic subgroups. However, with a projected increase in the participation of minorities in the Navy, such work should become more feasible.

Although some of the results of this thesis coincide with the results of other authors (Cooke and Quester, 1992; Robinson and Prevetta, 1992) who use different methodologies, multiple regression analysis (if used correctly) seems to produce more reliable results, when compared with other methods, such as cross tabulations and control charts.

The R-squared values for the basic models are fairly high, indicating the highly predictive power of these basic

models. This is reenforced by the highly significant individual coefficients for the control variables. Although one never knows whether the chosen model specification includes all relevant variables, the chosen set of explanatory variables (in their specific form) produces coefficients with the power to reliably forecast time-in-service to the grades E-4, E-5, and E-6.

C. EFFECTIVENESS OF EQUAL OPPORTUNITY PROGRAMS

As previously mentioned, one method to analyze the possible effect of equal opportunity programs on promotion times within the three cohorts would be to use multiple regression analysis (for each cohort separately). The problem is that these regression results only indirectly reflect on how Equal Opportunity and Affirmative Action programs have worked with respect to promotions. This is, because the Navy's Equal Opportunity and Affirmative Action programs were introduced more than a decade ago, and more than one program shared the common objective of increasing equal opportunity awareness. Since the population in question cannot be divided in two subgroups (pre-treatment group and post-treatment group), a direct comparison of the pre-EO and post-EO periods is not possible. Although there are statistical procedures who could resolve this dilemma, they are beyond the focus of this thesis.

However, it may be possible to draw some inferences from the results provided by the statistical analysis. This discussion will put the regression results into context. Dye (1994) describes the evolution of Navy service-wide programs:

> . . . the Navy began its first efforts at increasing racial awareness in January 1972 with Navy-wide race

> relations training. By 1978, the Navy had instituted the Navy Affirmative Action Plan (NAAP), a comprehensive equal opportunity program still in effect today. The NAAP identifies specific categories in which the Navy will take positive, affirmative steps to achieve a demographically-balanced composition of personnel ensuring fair treatment and freedom from discrimination. . . . Promotion . . . [is] among the categories monitored. (Dye, 1994, p. 23)

The expectation for the results of the regressions then may be that promotion times for minorities have been decreasing, thereby approaching the values of the majority. Although the author does not know what the time-to-promotion would be <u>in the absence of equal opportunity programs</u>, the results indicate that the promotion times for racial or ethnic minorities do not always decrease. In some instances it takes minorities additional months to make the grade compared to older cohorts. On the other hand, for other minorities and for other grades in question, these data suggest an improvement in the situation for the more recent cohort members.

The trend observed for promotion to E-4 is reversed for promotion to E-6 (refer to Table VIII). Looking back from 1985 cohort data, the time to promotion for members of racial/ethnic minorities has improved dramatically. One could speculate from these data that Equal Opportunity and Affirmative Action programs for racial/ethnic minorities may be more effective in the more senior ranks of the enlisted force. However, the data imply that in 1992 there is still a disadvantage of about two additional months for a racial/ethnic minority member in promotion to E-6. This number is impressively low (less than seven percent) compared with the comparable additional <u>nine</u> months to promotion for cohort 1979. One may carefully interpret these numbers as indicating progress due to equal opportunity awareness caused in part by

equal opportunity programs.

The results of this analysis support the conclusion that racial/ethnic minorities, as a whole, have slower times to promotion to E-4, E-5, and E-6 in the Navy, all else equal. However, the magnitude of the difference between minorities and the majority decreases for more recent cohorts and for promotion to more senior grades. The data imply that the Navy's equal opportunity programs may have helped in reducing promotion times for racial/ethnic minority members. However, since racial/ethnic minorities generally advance through the ranks at a slower rate than their majority counterparts, it is recommended that these programs be maintained.

It should be noted that the general trend for minorities results mostly from the outcome of the largest component group, blacks or African-American. The promotion situation for smaller groups of racial/ethnic minorities may be quite different: that is, some have an extremely longer time for promotion to any of the grades in question, while others are promoted faster than the majority. Although the results for these smaller groups are not all significant, one may conclude that equal opportunity programs in the Navy may have been more successful worked for blacks more than for some other racial/ethnic minorities. Further, the data suggest that there is still a need for equal opportunity and affirmative action programs. Progress has been made in creating a system of promotion that is increasingly fair with respect to racial/ethnic minorities. But there is still progress to make, as the results of this study show; and, after achieving equal promotion times for "racial/ethnic minority members" as a whole, smaller minority groups (Filipino-Americans for example) may still be in particular need of equal opportunity initiatives.

APPENDIX A. CONTENTS PROCEDURE

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Observations:          232742
Member Type:   DATA
Variables:             109
Engine:        V607
Indexes:               0
Created:       11:50 Wednesday, March 29, 1995
Observation Length:    872
Last Modified: 11:50 Wednesday, March 29, 1995
Deleted Observations:  0
Compressed:            NO
Sorted:                NO

     -----Engine/Host Dependent Information-----

              Data Set Page Size:         46080
              Number of Data Set Pages:   4477
              File Format:                607
              First Data Page:            1
              Max Obs per Page:           52
              Obs in First Data Page:     36
              Physical Name:              MSS.S1317.ABRI
              Release Created:            6.07
              Release Last Modified:      6.07
              Created by:                 DIPL5XX
              Last Modified by:           DIPL5XX
              Subextents:                 5
              Total Blocks Used:          8954
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-----Alphabetic List of Variables and Attributes-----

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63	AFQT4	Num	8	496
9	AFQTGRPS	Num	8	64
8	AFQTPRCT	Num	8	56
62	AFQT3B	Num	8	488
64	AGESQ	Num	8	504
79	ALEUT	Num	8	624
108	AMIN_RE	Num	8	856
74	ASIANAM	Num	8	584
71	BLACK	Num	8	560
86	BLACK_RE	Num	8	680
81	CHINESE	Num	8	640
16	COHORTFY	Num	8	120
48	CPGRDM10	Num	8	376
51	CPGRDM11	Num	8	400
54	CPGRDM12	Num	8	424
57	CPGRDM13	Num	8	448
60	CPGRDM14	Num	8	472
21	CPGRDMY1	Num	8	160
24	CPGRDMY2	Num	8	184
27	CPGRDMY3	Num	8	208
30	CPGRDMY4	Num	8	232
33	CPGRDMY5	Num	8	256
36	CPGRDMY6	Num	8	280
39	CPGRDMY7	Num	8	304
42	CPGRDMY8	Num	8	328
45	CPGRDMY9	Num	8	352
47	CPGRDY10	Num	8	368
50	CPGRDY11	Num	8	392
53	CPGRDY12	Num	8	416
56	CPGRDY13	Num	8	440
59	CPGRDY14	Num	8	464
20	CPGRDYY1	Num	8	152
23	CPGRDYY2	Num	8	176
26	CPGRDYY3	Num	8	200
29	CPGRDYY4	Num	8	224
32	CPGRDYY5	Num	8	248
35	CPGRDYY6	Num	8	272
38	CPGRDYY7	Num	8	296
41	CPGRDYY8	Num	8	320
44	CPGRDYY9	Num	8	344
80	CUBAN	Num	8	632
95	E4	Num	8	752
96	E5	Num	8	760
97	E6	Num	8	768
14	ENLTERM	Num	8	104

15	ENTRGRAD	Num	8	112
11	ENTRSTAT	Num	8	80
1	ENTRYAGE	Num	8	0
13	ENTRYDTM	Num	8	96
12	ENTRYDTY	Num	8	88
78	ESKIMO	Num	8	616
5	ETHNIC	Num	8	32
76	FILIPIN	Num	8	600
107	HISP_RE	Num	8	848
2	HIYREDUC	Num	8	
100	INDIAN	Num	8	792
109	ISLA_RE	Num	8	864
82	JAPANESE	Num	8	648
83	KOREAN	Num	8	656
98	LATINAM	Num	8	776
87	MALAYAN	Num	8	688
68	MARR	Num	8	536
70	MARRPL	Num	8	552
7	MARST_DP	Num	8	48
103	MELANES	Num	8	816
77	MEXICAN	Num	8	608
104	MICRONES	Num	8	824
89	MONTHIN	Num	8	704
90	MONTHOUT	Num	8	712
73	NATIND	Num	8	576
102	OASIAN	Num	8	808
66	OBLIL	Num	8	520
65	OBLIS	Num	8	512
99	OHISPAN	Num	8	784
46	PGRAD10	Num	8	360
49	PGRAD11	Num	8	384
52	PGRAD12	Num	8	408
55	PGRAD13	Num	8	432
58	PGRAD14	Num	8	456
19	PGRADY1	Num	8	144
22	PGRADY2	Num	8	168
25	PGRADY3	Num	8	192
28	PGRADY4	Num	8	216
31	PGRADY5	Num	8	240
34	PGRADY6	Num	8	264
37	PGRADY7	Num	8	288
40	PGRADY8	Num	8	312
43	PGRADY9	Num	8	336
105	POLYNES	Num	8	832
10	PRIORSVC	Num	8	72
75	PUERTRI	Num	8	592
4	RACE	Num	8	24
6	RACETHNC	Num	8	40
18	SEPDAT_M	Num	8	136
17	SEPDAT_Y	Num	8	128
3	SEX	Num	8	16

67	SINGLE	Num	8	528
69	SINGLEPL	Num	8	544
72	SPANISH	Num	8	568
88	STILSVC	Num	8	696
91	TINSVC	Num	8	720
92	TTOE4	Num	8	728
93	TTOE5	Num	8	736
94	TTOE6	Num	8	744
101	VIETNAM	Num	8	800
106	WHITE	Num	8	840
84	WHITENSP	Num	8	664
85	WHITESPN	Num	8	672

APPENDIX B. CODING FOR DATASET

```
//DIPL05A   JOB USER=S1317,CLASS=B
//   EXEC SAS
//SASFL   DD DISP=SHR,DSN=MSS.S1317.ORIG9
//SASFOUT DD DISP=(OLD,KEEP),DSN=MSS.S1317.ABRI9
//SYSIN DD *

DATA SASFOUT.ABRI9(KEEP=

                 COHORTFY

                 RACE ETHNIC RACETHNC SEPDAT_M SEPDAT_Y
                 ENTRYDTM ENTRYDTY ENTRYAGE SEX MARST_DP
                 AFQTPRCT ENTRGRAD PRIORSVC ENTRSTAT
                 HIYREDUC MONTHIN MONTHOUT STILSVC TINSVC

                 PGRADY1 PGRADY2 PGRADY3
                 PGRADY6 PGRADY5 PGRADY4
                 PGRADY7 PGRADY8 PGRADY9
                 PGRAD12 PGRAD11 PGRAD10
                 PGRAD13 PGRAD14

                 SINGLE SINGLEPL MARR MARRPL
                 AFQTGRPS AFQT1 AFQT3B AFQT4
                 AGESQ ENLTERM OBLIS OBLIL

                 TTOE4 TTOE5 TTOE6 E4 E5 E6

                 CPGRDYY1 CPGRDMY1
                 CPGRDYY2 CPGRDMY2
                 CPGRDYY3 CPGRDMY3
                 CPGRDYY4 CPGRDMY4
                 CPGRDYY5 CPGRDMY5
                 CPGRDYY6 CPGRDMY6
                 CPGRDYY7 CPGRDMY7
                 CPGRDYY8 CPGRDMY8
                 CPGRDYY9 CPGRDMY9
                 CPGRDY10 CPGRDM10
                 CPGRDY11 CPGRDM11
                 CPGRDY12 CPGRDM12
                 CPGRDY13 CPGRDM13
                 CPGRDY14 CPGRDM14

                 SPANISH NATIND ASIANAM PUERTRI FILIPIN
                 MEXICAN ESKIMO ALEUT CUBAN CHINESE
                 JAPANESE KOREAN
                 WHITENSP WHITESPN BLACK_RE MALAYAN

                 LATINAM OHISPAN INDIAN VIETNAM OASIAN
```

```
                MELANES MICRONES POLYNES WHITE HISP_RE
                AMIN_RE ISLA_RE;

SET SASFL.ORIG9 ;

    IF RACE > 0                 ;
    IF ETHNIC > 0               ;
    IF RACETHNC > 0             ;
    IF SEPDAT_Y > 77
    AND COHORTFY = 79  OR
    (SEPDAT_Y > 80
    AND COHORTFY = 82) OR
    (SEPDAT_Y > 83
    AND COHORTFY = 85) OR
     SEPDAT_Y = 0               ;
    IF ENTRYDTM > 0             ;
    IF (ENTRYDTY = 78
    AND COHORTFY = 79) OR
     (ENTRYDTY = 79
    AND COHORTFY = 79) OR
     (ENTRYDTY = 81
    AND COHORTFY = 82) OR
     (ENTRYDTY = 82
    AND COHORTFY = 82) OR
     (ENTRYDTY = 84
    AND COHORTFY = 85) OR
     (ENTRYDTY = 85
    AND COHORTFY = 85)          ;
    IF ENTRYAGE >16  AND
       ENTRYAGE < 34            ;
    IF SEX > 0                  ;
    IF MARST_DP > 0             ;
    IF AFQTPRCT > 0             ;
    IF ENTRGRAD > 0             ;
    IF PRIORSVC = 1             ;
    IF ENTRSTAT > 0             ;
    IF ENTRGRAD <= 3            ;

    IF AFQTGRPS GE 6 THEN AFQT1 = 1;
       ELSE AFQT1 = 0;
    IF AFQTGRPS =  5 THEN AFQT3B = 1;
       ELSE AFQT3B   = 0;
    IF AFQTGRPS = 2 OR AFQTGRPS = 3 OR AFQTGRPS = 4
       THEN AFQT4    = 1;
       ELSE AFQT4     = 0;

    AGESQ = ENTRYAGE * ENTRYAGE;

    IF ENLTERM LE 3 THEN OBLIS = 1;
       ELSE OBLIS = 0;
    IF ENLTERM GT 3 THEN OBLIL = 1;
```

```
   ELSE OBLIL = 0;

IF MARST_DP = 10  THEN SINGLE = 1;
   ELSE SINGLE = 0;
IF MARST_DP = 20  THEN MARR = 1;
   ELSE MARR = 0;
IF MARST_DP GT 10 AND MARST_DP LT 20 THEN SINGLEPL = 1;
   ELSE SINGLEPL = 0;
IF MARST_DP GT 20  THEN MARRPL = 1;
   ELSE MARRPL = 0;

/* =====CREATING VALID DUMMYS FOR RACE===== */

IF COHORTFY = 79 AND
RACE = 2 THEN BLACK = 1;
     ELSE BLACK = 0;
IF COHORTFY = 79 AND
ETHNIC = 1 THEN SPANISH = 1;
     ELSE SPANISH = 0;
IF COHORTFY = 79 AND
ETHNIC = 2 THEN NATIND  = 1;
     ELSE NATIND  = 0;
IF COHORTFY = 79 AND
ETHNIC = 3 THEN ASIANAM = 1;
     ELSE ASIANAM = 0;
IF COHORTFY = 79 AND
ETHNIC = 4 THEN PUERTRI = 1;
     ELSE PUERTRI = 0;
IF COHORTFY = 79 AND
ETHNIC = 5 THEN FILIPIN = 1;
     ELSE FILIPIN = 0;
IF COHORTFY = 79 AND
ETHNIC = 6 THEN MEXICAN = 1;
     ELSE MEXICAN = 0;
IF COHORTFY = 79 AND
ETHNIC = 7 THEN ESKIMO =  1;
     ELSE ESKIMO = 0;
IF COHORTFY = 79 AND
ETHNIC = 8 THEN ALEUT  =  1;
     ELSE ALEUT = 0;
IF COHORTFY = 79 AND
ETHNIC = 9 THEN CUBAN =   1;
     ELSE CUBAN = 0;
IF COHORTFY = 79 AND
ETHNIC = 10 THEN CHINESE  = 1;
     ELSE CHINESE = 0;
IF COHORTFY = 79 AND
ETHNIC = 11 THEN JAPANESE = 1;
     ELSE JAPANESE = 0;
IF COHORTFY = 79 AND
ETHNIC = 12 THEN KOREAN   = 1;
```

```
      ELSE KOREAN = 0;

 IF COHORTFY = 79 AND
 RACETHNC = 1 THEN WHITENSP = 1;
      ELSE WHITENSP = 0;
 IF COHORTFY = 79 AND
 RACETHNC = 2 THEN WHITESPN = 1;
      ELSE WHITESPN = 0;
 IF COHORTFY = 79 AND
 RACETHNC = 3 THEN BLACK_RE = 1;
      ELSE BLACK_RE = 0;
 IF COHORTFY = 79 AND
 RACETHNC = 4 THEN MALAYAN = 1;
      ELSE MALAYAN = 0;

 /* ========CREATING THE TIMELINE=========== */

 IF SEPDAT_Y = 0  THEN STILSVC = 1;
 ELSE STILSVC = 0;

 IF ENTRYDTY = 78 THEN MONTHIN = ENTRYDTM ;
 IF ENTRYDTY = 79 THEN MONTHIN = ENTRYDTM + 12;

 IF SEPDAT_Y = 78 AND COHORTFY = 79
 THEN MONTHOUT = SEPDAT_M ;
 IF SEPDAT_Y > 78 AND COHORTFY = 79
 THEN MONTHOUT = SEPDAT_M + 12
                             + ((SEPDAT_Y - 79) * 12);

IF ENTRYDTY = 81 THEN MONTHIN = ENTRYDTM ;
IF ENTRYDTY = 82 THEN MONTHIN = ENTRYDTM + 12;

IF SEPDAT_Y = 81 AND COHORTFY = 82
THEN MONTHOUT = SEPDAT_M ;
IF SEPDAT_Y > 81 AND COHORTFY = 82
THEN MONTHOUT = SEPDAT_M + 12
                             + ((SEPDAT_Y - 82) * 12);

IF ENTRYDTY = 84 THEN MONTHIN = ENTRYDTM ;
IF ENTRYDTY = 85 THEN MONTHIN = ENTRYDTM + 12;

IF SEPDAT_Y = 84 AND COHORTFY = 85
THEN MONTHOUT = SEPDAT_M ;
IF SEPDAT_Y > 84 AND COHORTFY = 85
THEN MONTHOUT = SEPDAT_M + 12
                             + ((SEPDAT_Y - 85) * 12);

 TINSVC = MONTHOUT - MONTHIN;

 /* ========CREATING THE PROMOTIONTIMELINE=========== */
 IF PGRADY1 = 4 AND
```

```
CPGRDYY1 = 78 THEN TTOE4 = CPGRDMY1 - MONTHIN;
IF PGRADY1 = 4 AND
CPGRDYY1 GT 78 THEN TTOE4 = CPGRDMY1 + 12 - MONTHIN
                             + ((CPGRDYY1 - 79) * 12);

IF PGRADY2 = 4 AND
PGRADY1 LT 4 AND
CPGRDYY2 = 78 THEN TTOE4 = CPGRDMY2 - MONTHIN;
IF PGRADY2 = 4 AND
PGRADY1 LT 4 AND
CPGRDYY2 GT 78 THEN TTOE4 = CPGRDMY2 + 12 - MONTHIN
                             + ((CPGRDYY2 - 79) * 12);
IF PGRADY3 = 4 AND
PGRADY2 LT 4 AND
CPGRDYY3 = 78 THEN TTOE4 = CPGRDMY3 - MONTHIN;
IF PGRADY3 = 4 AND
PGRADY2 LT 4 AND
CPGRDYY3 GT 78 THEN TTOE4 = CPGRDMY3 + 12 - MONTHIN
                             + ((CPGRDYY3 - 79) * 12);

IF PGRADY4 = 4 AND
PGRADY3 LT 4 AND
CPGRDYY4 = 78 THEN TTOE4 = CPGRDMY4 - MONTHIN;
IF PGRADY4 = 4 AND
PGRADY3 LT 4 AND
CPGRDYY4 GT 78 THEN TTOE4 = CPGRDMY4 + 12 - MONTHIN
                             + ((CPGRDYY4 - 79) * 12);
IF PGRADY5 = 4 AND
PGRADY4 LT 4 AND
CPGRDYY5 = 78 THEN TTOE4 = CPGRDMY5 - MONTHIN;
IF PGRADY5 = 4 AND
PGRADY4 LT 4 AND
CPGRDYY5 GT 78 THEN TTOE4 = CPGRDMY5 + 12 - MONTHIN
                             + ((CPGRDYY5 - 79) * 12);

IF PGRADY6 = 4 AND
PGRADY5 LT 4 AND
CPGRDYY6 = 78 THEN TTOE4 = CPGRDMY6 - MONTHIN;
IF PGRADY6 = 4 AND
PGRADY5 LT 4 AND
CPGRDYY6 GT 78 THEN TTOE4 = CPGRDMY6 + 12 - MONTHIN
                             + ((CPGRDYY6 - 79) * 12);
IF PGRADY7 = 4 AND
PGRADY6 LT 4 AND
CPGRDYY7 = 78 THEN TTOE4 = CPGRDMY7 - MONTHIN;
IF PGRADY7 = 4 AND
PGRADY6 LT 4 AND
CPGRDYY7 GT 78 THEN TTOE4 = CPGRDMY7 + 12 - MONTHIN
                             + ((CPGRDYY7 - 79) * 12);

IF PGRADY8 = 4 AND
```

```
PGRADY7 LT 4 AND
CPGRDYY8 = 78 THEN TTOE4 = CPGRDMY8 - MONTHIN;
IF PGRADY8 = 4 AND
PGRADY7 LT 4 AND
CPGRDYY8 GT 78 THEN TTOE4 = CPGRDMY8 + 12 - MONTHIN
                              + ((CPGRDYY8 - 79) * 12);

IF PGRADY1 = 5 AND
CPGRDYY1 = 78 THEN TTOE5 = CPGRDMY1 - MONTHIN;
IF PGRADY1 = 5 AND
CPGRDYY1 GT 78 THEN TTOE5 = CPGRDMY1 + 12 - MONTHIN
                              + ((CPGRDYY1 - 79) * 12);



IF PGRADY2 = 5 AND
PGRADY1 LT 5 AND
CPGRDYY2 = 78 THEN TTOE5 = CPGRDMY2 - MONTHIN;
IF PGRADY2 = 5 AND
PGRADY1 LT 5 AND
CPGRDYY2 GT 78 THEN TTOE5 = CPGRDMY2 + 12 - MONTHIN
                              + ((CPGRDYY2 - 79) * 12);
IF PGRADY3 = 5 AND
PGRADY2 LT 5 AND
CPGRDYY3 = 78 THEN TTOE5 = CPGRDMY3 - MONTHIN;
IF PGRADY3 = 5 AND
PGRADY2 LT 5 AND
CPGRDYY3 GT 78 THEN TTOE5 = CPGRDMY3 + 12 - MONTHIN
                              + ((CPGRDYY3 - 79) * 12);

IF PGRADY4 = 5 AND
PGRADY3 LT 5 AND
CPGRDYY4 = 78 THEN TTOE5 = CPGRDMY4 - MONTHIN;
IF PGRADY4 = 5 AND
PGRADY3 LT 5 AND
CPGRDYY4 GT 78 THEN TTOE5 = CPGRDMY4 + 12 - MONTHIN
                              + ((CPGRDYY4 - 79) * 12);
IF PGRADY5 = 5 AND
PGRADY4 LT 5 AND
CPGRDYY5 = 78 THEN TTOE5 = CPGRDMY5 - MONTHIN;
IF PGRADY5 = 5 AND
PGRADY4 LT 5 AND
CPGRDYY5 GT 78 THEN TTOE5 = CPGRDMY5 + 12 - MONTHIN
                              + ((CPGRDYY5 - 79) * 12);

IF PGRADY6 = 5 AND
PGRADY5 LT 5 AND
CPGRDYY6 = 78 THEN TTOE5 = CPGRDMY6 - MONTHIN;
IF PGRADY6 = 5 AND
PGRADY5 LT 5 AND
CPGRDYY6 GT 78 THEN TTOE5 = CPGRDMY6 + 12 - MONTHIN
```

```
                                   + ((CPGRDYY6 - 79) * 12);
IF PGRADY7 = 5 AND
PGRADY6 LT 5 AND
CPGRDYY7 = 78 THEN TTOE5 = CPGRDMY7 - MONTHIN;
IF PGRADY7 = 5 AND
PGRADY6 LT 5 AND
CPGRDYY7 GT 78 THEN TTOE5 = CPGRDMY7 + 12 - MONTHIN
                                   + ((CPGRDYY7 - 79) * 12);

IF PGRADY8 = 5 AND
PGRADY7 LT 5 AND
CPGRDYY8 = 78 THEN TTOE5 = CPGRDMY8 - MONTHIN;
IF PGRADY8 = 5 AND
PGRADY7 LT 5 AND
CPGRDYY8 GT 78 THEN TTOE5 = CPGRDMY8 + 12 - MONTHIN
                                   + ((CPGRDYY8 - 79) * 12);


IF PGRADY9 = 5 AND
PGRADY8 LT 5 AND
CPGRDYY9 = 78 THEN TTOE5 = CPGRDMY9 - MONTHIN;
IF PGRADY9 = 5 AND
PGRADY8 LT 5 AND
CPGRDYY9 GT 78 THEN TTOE5 = CPGRDMY9 + 12 - MONTHIN
                                   + ((CPGRDYY9 - 79) * 12);
IF PGRAD10 = 5 AND
PGRADY9 LT 5 AND
CPGRDY10 = 78 THEN TTOE5 = CPGRDM10 - MONTHIN;
IF PGRAD10= 5 AND
PGRADY9 LT 5 AND
CPGRDY10 GT 78 THEN TTOE5 = CPGRDM10 + 12 - MONTHIN
                                   + ((CPGRDY10 - 79) * 12);

IF PGRAD11 = 5 AND
PGRAD10 LT 5 AND
CPGRDY11 = 78 THEN TTOE5 = CPGRDM11 - MONTHIN;
IF PGRAD11 = 5 AND
PGRAD10 LT 5 AND
CPGRDY11 GT 78 THEN TTOE5 = CPGRDM11 + 12 - MONTHIN
                                   + ((CPGRDY11 - 79) * 12);
IF PGRAD12 = 5 AND
PGRAD11 LT 5 AND
CPGRDY12 = 78 THEN TTOE5 = CPGRDM12 - MONTHIN;
IF PGRAD12 = 5 AND
PGRAD11 LT 5 AND
CPGRDY12 GT 78 THEN TTOE5 = CPGRDM12 + 12 - MONTHIN
                                   + ((CPGRDY12 - 79) * 12);

IF PGRAD13 = 5 AND
PGRAD12 LT 5 AND
CPGRDY13 = 78 THEN TTOE5 = CPGRDM13 - MONTHIN;
```

```
IF PGRAD13 = 5 AND
PGRAD12 LT 5 AND
CPGRDY13 GT 78 THEN TTOE5 = CPGRDM13 + 12 - MONTHIN
                              + ((CPGRDY13 - 79) * 12);
IF PGRAD14 = 5 AND
PGRAD13 LT 5 AND
CPGRDY14 = 78 THEN TTOE5 = CPGRDM14 - MONTHIN;
IF PGRAD14 = 5 AND
PGRAD13 LT 5 AND
CPGRDY14 GT 78 THEN TTOE5 = CPGRDM14 + 12 - MONTHIN
                              + ((CPGRDY14 - 79) * 12);



IF PGRADY1 = 6 AND
CPGRDYY1 = 78 THEN TTOE6 = CPGRDMY1 - MONTHIN;
IF PGRADY1 = 6 AND
CPGRDYY1 GT 78 THEN TTOE6 = CPGRDMY1 + 12 - MONTHIN
                              + ((CPGRDYY1 - 79) * 12);



IF PGRADY2 = 6 AND
PGRADY1 LT 6 AND
CPGRDYY2 = 78 THEN TTOE6 = CPGRDMY2 - MONTHIN;
IF PGRADY2 = 6 AND
PGRADY1 LT 6 AND
CPGRDYY2 GT 78 THEN TTOE6 = CPGRDMY2 + 12 - MONTHIN
                              + ((CPGRDYY2 - 79) * 12);
IF PGRADY3 = 6 AND
PGRADY2 LT 6 AND
CPGRDYY3 = 78 THEN TTOE6 = CPGRDMY3 - MONTHIN;
IF PGRADY3 = 6 AND
PGRADY2 LT 6 AND
CPGRDYY3 GT 78 THEN TTOE6 = CPGRDMY3 + 12 - MONTHIN
                              + ((CPGRDYY3 - 79) * 12);

IF PGRADY4 = 6 AND
PGRADY3 LT 6 AND
CPGRDYY4 = 78 THEN TTOE6 = CPGRDMY4 - MONTHIN;
IF PGRADY4 = 6 AND
PGRADY3 LT 6 AND
CPGRDYY4 GT 78 THEN TTOE6 = CPGRDMY4 + 12 - MONTHIN
                              + ((CPGRDYY4 - 79) * 12);
IF PGRADY5 = 6 AND
PGRADY4 LT 6 AND
CPGRDYY5 = 78 THEN TTOE6 = CPGRDMY5 - MONTHIN;
IF PGRADY5 = 6 AND
PGRADY4 LT 6 AND
CPGRDYY5 GT 78 THEN TTOE6 = CPGRDMY5 + 12 - MONTHIN
```

```
                              + ((CPGRDYY5 - 79) * 12);

IF PGRADY6 = 6 AND
PGRADY5 LT 6 AND
CPGRDYY6 = 78 THEN TTOE6 = CPGRDMY6 - MONTHIN;
IF PGRADY6 = 6 AND
PGRADY5 LT 6 AND
CPGRDYY6 GT 78 THEN TTOE6 = CPGRDMY6 + 12 - MONTHIN
                              + ((CPGRDYY6 - 79) * 12);
IF PGRADY7 = 6 AND
PGRADY6 LT 6 AND
CPGRDYY7 = 78 THEN TTOE6 = CPGRDMY7 - MONTHIN;
IF PGRADY7 = 6 AND
PGRADY6 LT 6 AND
CPGRDYY7 GT 78 THEN TTOE6 = CPGRDMY7 + 12 - MONTHIN
                              + ((CPGRDYY7 - 79) * 12);

IF PGRADY8 = 6 AND
PGRADY7 LT 6 AND
CPGRDYY8 = 78 THEN TTOE6 = CPGRDMY8 - MONTHIN;
IF PGRADY8 = 6 AND
PGRADY7 LT 6 AND
CPGRDYY8 GT 78 THEN TTOE6 = CPGRDMY8 + 12 - MONTHIN
                              + ((CPGRDYY8 - 79) * 12);


IF PGRADY9 = 6 AND
PGRADY8 LT 6 AND
CPGRDYY9 = 78 THEN TTOE6 = CPGRDMY9 - MONTHIN;
IF PGRADY9 = 6 AND
PGRADY8 LT 6 AND
CPGRDYY9 GT 78 THEN TTOE6 = CPGRDMY9 + 12 - MONTHIN
                              + ((CPGRDYY9 - 79) * 12);
IF PGRAD10 = 6 AND
PGRADY9 LT 6 AND
CPGRDY10 = 78 THEN TTOE6 = CPGRDM10 - MONTHIN;
IF PGRAD10= 6 AND
PGRADY9 LT 6 AND
CPGRDY10 GT 78 THEN TTOE6 = CPGRDM10 + 12 - MONTHIN
                              + ((CPGRDY10 - 79) * 12);

IF PGRAD11 = 6 AND
PGRAD10 LT 6 AND
CPGRDY11 = 78 THEN TTOE6 = CPGRDM11 - MONTHIN;
IF PGRAD11 = 6 AND
PGRAD10 LT 6 AND
CPGRDY11 GT 78 THEN TTOE6 = CPGRDM11 + 12 - MONTHIN
                              + ((CPGRDY11 - 79) * 12);
IF PGRAD12 = 6 AND
PGRAD11 LT 6 AND
CPGRDY12 = 78 THEN TTOE6 = CPGRDM12 - MONTHIN;
```

```
IF PGRAD12 = 6 AND
PGRAD11 LT 6 AND
CPGRDY12 GT 78 THEN TTOE6 = CPGRDM12 + 12 - MONTHIN
                             + ((CPGRDY12 - 79) * 12);

IF PGRAD13 = 6 AND
PGRAD12 LT 6 AND
CPGRDY13 = 78 THEN TTOE6 = CPGRDM13 - MONTHIN;
IF PGRAD13 = 6 AND
PGRAD12 LT 6 AND
CPGRDY13 GT 78 THEN TTOE6 = CPGRDM13 + 12 - MONTHIN
                             + ((CPGRDY13 - 79) * 12);
IF PGRAD14 = 6 AND
PGRAD13 LT 6 AND
CPGRDY14 = 78 THEN TTOE6 = CPGRDM14 - MONTHIN;
IF PGRAD14 = 6 AND
PGRAD13 LT 6 AND
CPGRDY14 GT 78 THEN TTOE6 = CPGRDM14 + 12 - MONTHIN
                             + ((CPGRDY14 - 79) * 12);


    /* ADDITIONAL CODING FOR THE REGRESSION ANALYSIS */


IF HISP_RE = 1 OR WHITESPN = 1 THEN HISPANIC = 1;
     ELSE HISPANIC = 0;
IF OHISPAN = 1 OR SPANISH = 1 THEN OHISP = 1;
     ELSE OHISP = 0;

IF ASIANAM = 1 OR ESKIMO = 1 OR ALEUT = 1 OR CUBAN = 1
           OR CHINESE = 1 OR JAPANESE = 1 OR KOREAN = 1
           OR MALAYAN = 1 OR LATINAM = 1 OR INDIAN = 1
           OR VIETNAM = 1 OR OASIAN = 1 OR MELANES = 1
           OR MICRONES = 1 OR POLYNES = 1 OR AMIN_RE = 1
           OR SPANISH = 1 OR NATIND = 1 OR PUERTRI = 1
           OR FILIPIN = 1 OR MEXICAN = 1 OR WHITESPN = 1
           OR BLACK = 1 OR LATINAM = 1 OR OHISPAN = 1
           OR HISP_RE = 1
           OR ISLA_RE = 1 THEN MINORITY =1 ;
     ELSE MINORITY = 0;

IF COHORTFY = 79 THEN FISCAL79 = 1;
     ELSE FISCAL79 = 0;

IF COHORTFY = 82 THEN FISCAL82 = 1;
     ELSE FISCAL82 = 0;

IF COHORTFY = 85 THEN FISCAL85 = 1;
     ELSE FISCAL85 = 0;
```

```
HIYREDSQ = HIYREDUC * HIYREDUC;

DETERMSQ = (ENTRYAGE-HIYREDUC) * (ENTRYAGE-HIYREDUC) ;

IF PGRADY1 = 3 AND
CPGRDYY1 = 78 THEN TTOE3 = CPGRDMY1 - MONTHIN;
IF PGRADY1 = 3 AND
CPGRDYY1 GT 78 THEN TTOE3 = CPGRDMY1 + 12 - MONTHIN
                              + ((CPGRDYY1 - 79) * 12);

IF PGRADY2 = 3 AND
PGRADY1 LT 3 AND
CPGRDYY2 = 78 THEN TTOE3 = CPGRDMY2 - MONTHIN;
IF PGRADY2 = 3 AND
PGRADY1 LT 3 AND
CPGRDYY2 GT 78 THEN TTOE3 = CPGRDMY2 + 12 - MONTHIN
                              + ((CPGRDYY2 - 79) * 12);
IF PGRADY3 = 3 AND
PGRADY2 LT 3 AND
CPGRDYY3 = 78 THEN TTOE3 = CPGRDMY3 - MONTHIN;
IF PGRADY3 = 3 AND
PGRADY2 LT 3 AND
CPGRDYY3 GT 78 THEN TTOE3 = CPGRDMY3 + 12 - MONTHIN
                              + ((CPGRDYY3 - 79) * 12);

IF PGRADY4 = 3 AND
PGRADY3 LT 3 AND
CPGRDYY4 = 78 THEN TTOE3 = CPGRDMY4 - MONTHIN;
IF PGRADY4 = 3 AND
PGRADY3 LT 3 AND
CPGRDYY4 GT 78 THEN TTOE3 = CPGRDMY4 + 12 - MONTHIN
                              + ((CPGRDYY4 - 79) * 12);
IF PGRADY5 = 3 AND
PGRADY4 LT 3 AND
CPGRDYY5 = 78 THEN TTOE3 = CPGRDMY5 - MONTHIN;
IF PGRADY5 = 3 AND
PGRADY4 LT 3 AND
CPGRDYY5 GT 78 THEN TTOE3 = CPGRDMY5 + 12 - MONTHIN
                              + ((CPGRDYY5 - 79) * 12);

IF PGRADY6 = 3 AND
PGRADY5 LT 3 AND
CPGRDYY6 = 78 THEN TTOE3 = CPGRDMY6 - MONTHIN;
IF PGRADY6 = 3 AND
PGRADY5 LT 3 AND
CPGRDYY6 GT 78 THEN TTOE3 = CPGRDMY6 + 12 - MONTHIN
                              + ((CPGRDYY6 - 79) * 12);


 IF PGRADY2 = 0 AND PGRADY1 = 3
```

```
        THEN PTTOE4 = TINSVC * 1 ;
IF PGRADY2 GE 3 THEN PTTOE4 = .;
IF PGRADY3 = 0 AND PGRADY2 = 3
        THEN PTTOE4 = TINSVC * 1 ;
IF PGRADY3 GE 3 THEN PTTOE4 = .;
IF PGRADY4 = 0 AND PGRADY3 = 3
        THEN PTTOE4 = TINSVC * 1 ;
IF PGRADY4 GE 3 THEN PTTOE4 = .;
IF PGRADY5 = 0 AND PGRADY4 = 3
        THEN PTTOE4 = TINSVC * 1 ;
IF PGRADY5 GE 3 THEN PTTOE4 = .;
IF PGRADY6 = 0 AND PGRADY5 = 3
        THEN PTTOE4 = TINSVC * 1;
IF PGRADY6 GE 3 THEN PTTOE4 = .;
IF PGRADY7 = 0 AND PGRADY6 = 3
        THEN PTTOE4 = TINSVC * 1;
IF PGRADY7 GE 3 THEN PTTOE4 = .;
IF PGRADY8 = 0 AND PGRADY7 = 3
        THEN PTTOE4 = TINSVC * 1;
IF PGRADY8 GE 3 THEN PTTOE4 = .;
IF PGRADY9 = 0 AND PGRADY8 = 3
        THEN PTTOE4 = TINSVC * 1;
IF PGRADY9 GE 3 THEN PTTOE4 = .;

IF PGRADY2 = 0 AND PGRADY1 = 4
        THEN PTTOE5 = TINSVC * 1 ;
IF PGRADY2 GE 4 THEN PTTOE5 = .;
IF PGRADY3 = 0 AND PGRADY2 = 4
        THEN PTTOE5 = TINSVC * 1 ;
IF PGRADY3 GE 4 THEN PTTOE5 = .;
IF PGRADY4 = 0 AND PGRADY3 = 4
        THEN PTTOE5 = TINSVC * 1 ;
IF PGRADY4 GE 4 THEN PTTOE5 = .;
IF PGRADY5 = 0 AND PGRADY4 = 4
        THEN PTTOE5 = TINSVC * 1 ;
IF PGRADY5 GE 4 THEN PTTOE5 = .;
IF PGRADY6 = 0 AND PGRADY5 = 4
        THEN PTTOE5 = TINSVC * 1 ;
IF PGRADY6 GE 4 THEN PTTOE5 = .;
IF PGRADY7 = 0 AND PGRADY6 = 4
        THEN PTTOE5 = TINSVC * 1 ;
IF PGRADY7 GE 4 THEN PTTOE5 = .;
IF PGRADY8 = 0 AND PGRADY7 = 4
        THEN PTTOE5 = TINSVC * 1 ;
IF PGRADY8 GE 4 THEN PTTOE5 = .;
IF PGRADY9 = 0 AND PGRADY8 = 4
        THEN PTTOE5 = TINSVC * 1 ;
IF PGRADY9 GE 4 THEN PTTOE5 = .;
IF PGRAD10 = 0 AND PGRADY9 = 4
        THEN PTTOE5 = TINSVC * 1 ;
IF PGRAD10 GE 4 THEN PTTOE5 = .;
```

```
IF PGRAD11 = 0 AND PGRAD10 = 4
        THEN PTTOE5 = TINSVC * 1 ;
IF PGRAD11 GE 4 THEN PTTOE5 = .;
IF PGRAD12 = 0 AND PGRAD11 = 4
        THEN PTTOE5 = TINSVC * 1 ;
IF PGRAD12 GE 4 THEN PTTOE5 = .;
IF PGRAD13 = 0 AND PGRAD12 = 4
        THEN PTTOE5 = TINSVC * 1 ;
IF PGRAD13 GE 4 THEN PTTOE5 = .;
IF PGRAD14 = 0 AND PGRAD13 = 4
        THEN PTTOE5 = TINSVC * 1 ;
IF PGRAD14 GE 4 THEN PTTOE5 = .;

IF PGRADY2 = 0 AND PGRADY1 = 5
        THEN PTTOE6 = TINSVC * 1 ;
IF PGRADY2 GE 4 THEN PTTOE5 = .;
IF PGRADY3 = 0 AND PGRADY2 = 5
        THEN PTTOE6 = TINSVC * 1 ;
IF PGRADY3 GE 4 THEN PTTOE5 = .;
IF PGRADY4 = 0 AND PGRADY3 = 5
        THEN PTTOE6 = TINSVC * 1 ;
IF PGRADY4 GE 4 THEN PTTOE5 = .;
IF PGRADY5 = 0 AND PGRADY4 = 5
        THEN PTTOE6 = TINSVC * 1 ;
IF PGRADY5 GE 4 THEN PTTOE5 = .;
IF PGRADY6 = 0 AND PGRADY5 = 5
        THEN PTTOE6 = TINSVC * 1 ;
IF PGRADY6 GE 4 THEN PTTOE5 = .;
IF PGRADY7 = 0 AND PGRADY6 = 5
        THEN PTTOE6 = TINSVC * 1 ;
IF PGRADY7 GE 4 THEN PTTOE5 = .;
IF PGRADY8 = 0 AND PGRADY7 = 5
        THEN PTTOE6 = TINSVC * 1 ;
IF PGRADY8 GE 4 THEN PTTOE5 = .;
IF PGRADY9 = 0 AND PGRADY8 = 5
        THEN PTTOE6 = TINSVC * 1 ;
IF PGRADY9 GE 4 THEN PTTOE5 = .;
IF PGRAD10 = 0 AND PGRADY9 = 5
        THEN PTTOE6 = TINSVC * 1 ;
IF PGRAD10 GE 4 THEN PTTOE5 = .;
IF PGRAD11 = 0 AND PGRAD10 = 5
        THEN PTTOE6 = TINSVC * 1 ;
IF PGRAD11 GE 4 THEN PTTOE5 = .;
IF PGRAD12 = 0 AND PGRAD11 = 5
        THEN PTTOE6 = TINSVC * 1 ;
IF PGRAD12 GE 4 THEN PTTOE5 = .;
IF PGRAD13 = 0 AND PGRAD12 = 5
        THEN PTTOE6 = TINSVC * 1 ;
IF PGRAD13 GE 4 THEN PTTOE5 = .;
IF PGRAD14 = 0 AND PGRAD13 = 5
        THEN PTTOE6 = TINSVC * 1;
```

```
IF PGRAD14 GE 4 THEN PTTOE5 = .;

IF PTTOE4 GT 0  THEN NEWTTOE4 = PTTOE4 * 1;
IF PTTOE4 = .   THEN NEWTTOE4 =     E4 * 1;
IF PTTOE5 GT 0  THEN NEWTTOE5 = PTTOE5 * 1;
IF PTTOE5 = .   THEN NEWTTOE5 =     E5 * 1;
IF PTTOE6 GT 0  THEN NEWTTOE6 = PTTOE6 * 1;
IF PTTOE6 = .   THEN NEWTTOE6 =     E6 * 1;


IF MOSINDEP GT 0 THEN DEP = 1;
      ELSE DEP = 0;
```

APPENDIX C. REGRESSION MODELS

Model: MODEL1
Dependent Variable: NEWTTOE4

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	21	8673822.3542	413039.15972	2231.157	0.0001
Error	164136	30385394.788	185.12328062		
C Total	164157	39059217.142			

Root MSE	13.60600	R-square	0.2221
Dep Mean	27.85524	Adj R-sq	0.2220
C.V.	48.84539		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	54.442587	0.64795996	84.022	0.0001
FISCAL79	1	0.366173	0.08597233	4.259	0.0001
FISCAL82	1	2.098092	0.08215269	25.539	0.0001
AGESQ	1	0.005349	0.00227925	2.347	0.0189
SEX	1	0.318747	0.10646065	2.994	0.0028
AFQT1	1	-4.610235	0.08222637	-56.068	0.0001
AFQT4	1	.900483	0.11280310	16.848	0.0001
DEP	1	-1.376593	0.16697304	-8.244	0.0001
ENTRGRAD	1	-6.276788	0.04506272	-139.290	0.0001
HIYREDUC	1	-3.763520	0.17912024	-21.011	0.0001
HIYREDSQ	1	0.204057	0.00772846	26.403	0.0001
DETERMSQ	1	-0.010662	0.00330329	-3.228	0.0012
OBLIS	1	-0.986894	0.49185247	-2.006	0.0448
SINGLEPL	1	-1.834872	0.37438103	-4.901	0.0001
MARRPL	1	-2.371276	0.16646198	-14.245	0.0001
BLACK	1	2.705209	0.09932842	27.235	0.0001
HISPANIC	1	.069781	0.31877286	3.356	0.0008
OHISP	1	0.313041	0.50856546	0.616	0.5382
MEXICAN	1	0.456251	0.37053600	1.231	0.2182
PUERTRI	1	.652344	0.44459038	3.717	0.0002
FILIPIN	1	0.224544	0.37754019	0.595	0.5520
NATIND	1	2.788387	0.67911924	4.106	0.0001

Model: MODEL2
Dependent Variable: NEWTTOE5

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	22	12843209.2	583782.23634	2461.579	0.0001
Error	74602	17692430.587	237.15759077		
C Total	74624	30535639.786			

Root MSE	15.39992	R-square	0.4206
Dep Mean	46.89339	Adj R-sq	0.4204
C.V.	32.84028		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	34.118515	1.21290748	28.130	0.0001
FISCAL79	1	-2.130723	0.14577252	-14.617	0.0001
FISCAL82	1	-0.669946	0.14175086	-4.726	0.0001
AGESQ	1	-0.013545	0.00386366	-3.506	0.0005
SEX	1	0.807795	0.18297292	4.415	0.0001
AFQT1	1	-1.958333	0.14962644	-13.088	0.0001
AFQT4	1	3.703080	0.21171236	17.491	0.0001
DEP	1	0.016844	0.30610872	0.055	0.9561
ENTRGRAD	1	.967706	0.07639723	25.756	0.0001
HIYREDUC	1	-1.736016	0.32623279	-5.321	0.0001
HIYREDSQ	1	0.104282	0.01426277	7.312	0.0001
DETERMSQ	1	0.012307	0.00558308	2.204	0.0275
OBLIS	1	.454930	0.86070078	1.690	0.0910
SINGLEPL	1	0.088597	0.59628880	0.149	0.8819
MARRPL	1	-1.158819	0.25469550	-4.550	0.0001
E4	1	0.902920	0.00475869	189.741	0.0001
BLACK	1	2.969506	0.17395207	17.071	0.0001
HISPANIC	1	0.566578	0.56021111	1.011	0.3118
OHISP	1	.710544	0.91762137	1.864	0.0623
MEXICAN	1	.111998	0.65281135	1.703	0.0885
PUERTRI	1	.673575	0.76016221	2.202	0.0277
FILIPIN	1	3.971153	0.55789221	7.118	0.0001
NATIND	1	-1.748430	1.25128827	-1.397	0.1623

Model: MODEL3
Dependent Variable: NEWTTOE6

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	23	6198788.2189	269512.53126	568.527	0.0001
Error	57490	27253366.1	474.05402853		
C Total	57513	33452154.319			

Root MSE	21.77278	R-square	0.1853
Dep Mean	76.49823	Adj R-sq	0.1850
C.V.	28.46181		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	61.214766	1.95862505	31.254	0.0001
FISCAL79	1	13.460385	0.24964726	53.918	0.0001
FISCAL82	1	9.797054	0.24493693	39.998	0.0001
AGESQ	1	-0.004329	0.00624234	-0.693	0.4880
SEX	1	3.231552	0.30036517	10.759	0.0001
AFQT1	1	-2.222155	0.24812842	-8.956	0.0001
AFQT4	1	3.481574	0.36166562	9.627	0.0001
DEP	1	-0.617737	0.52241921	-1.182	0.2370
ENTRGRAD	1	-0.955178	0.12225179	-7.813	0.0001
HIYREDUC	1	-2.654361	0.52160141	-5.089	0.0001
HIYREDSQ	1	0.151725	0.02265555	6.697	0.0001
DETERMSQ	1	0.011491	0.00906255	1.268	0.2048
OBLIS	1	0.533625	1.42123032	0.375	0.7073
SINGLEPL	1	-0.473015	0.96140150	-0.492	0.6227
MARRPL	1	.733569	0.42048512	4.123	0.0001
E4	1	-0.184968	0.00975005	-18.971	0.0001
E5	1	0.434915	0.00647238	67.196	0.0001
BLACK	1	6.831268	0.30598380	22.326	0.0001
HISPANIC	1	0.943340	0.87202878	1.082	0.2794
OHISP	1	-0.020015	1.50546054	-0.013	0.9894
MEXICAN	1	0.465867	1.03597390	0.450	0.6529
PUERTRI	1	2.508287	1.26323856	1.986	0.0471
FILIPIN	1	11.577590	1.02168142	11.332	0.0001
NATIND	1	-3.480770	2.11838688	-1.643	0.1004

Model: MODEL4
Dependent Variable: NEWTTOE4

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	15	8652072.4512	576804.83008	3113.673	0.0001
Error	164142	30407144.691	185.24902031		
C Total	164157	39059217.142			

Root MSE	13.61062	R-square	0.2215
Dep Mean	27.85524	Adj R-sq	0.2214
C.V.	48.86197		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	54.495869	0.64791675	84.109	0.0001
FISCAL79	1	0.348001	0.08592009	4.050	0.0001
FISCAL82	1	2.116487	0.08217398	25.756	0.0001
AGESQ	1	0.005491	0.00227988	2.409	0.0160
SEX	1	0.360314	0.10640465	3.386	0.0007
AFQT1	1	-4.645534	0.08216061	-56.542	0.0001
AFQT4	1	1.940654	0.11277614	17.208	0.0001
DEP	1	-1.369519	0.16702645	-8.199	0.0001
ENTRGRAD	1	-6.259999	0.04503086	-139.016	0.0001
HIYREDUC	1	-3.775182	0.17915726	-21.072	0.0001
HIYREDSQ	1	0.203965	0.00772979	26.387	0.0001
DETERMSQ	1	-0.011192	0.00330391	-3.388	0.0007
OBLIS	1	-0.971809	0.49201468	-1.975	0.0483
SINGLEPL	1	-1.750309	0.37440341	-4.675	0.0001
MARRPL	1	-2.399027	0.16648884	-14.410	0.0001
MINORITY	1	2.285267	0.08674301	26.345	0.0001

Durbin-Watson D	1.995
(For Number of Obs.)	164158
1st Order Autocorrelation	0.002

Model: MODEL5
Dependent Variable: NEWTTOE5

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	16	12834413.635	802150.85217	3380.945	0.0001
Error	74608	17701226.152	237.25640885		
C Total	74624	30535639.786			

Root MSE	15.40313	R-square	0.4203
Dep Mean	46.89339	Adj R-sq	0.4202
C.V.	32.84713		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	33.987159	1.21269129	28.026	0.0001
FISCAL79	1	-2.134892	0.14569138	-14.654	0.0001
FISCAL82	1	-0.646383	0.14176776	-4.559	0.0001
AGESQ	1	-0.013342	0.00386401	-3.453	0.0006
SEX	1	0.825761	0.18269085	4.520	0.0001
AFQT1	1	-1.997325	0.14946406	-13.363	0.0001
AFQT4	1	3.727789	0.21166543	17.612	0.0001
DEP	1	0.025680	0.30616828	0.084	0.9332
ENTRGRAD	1	1.961536	0.07629915	25.708	0.0001
HIYREDUC	1	-1.715614	0.32625743	-5.258	0.0001
HIYREDSQ	1	0.102911	0.01426279	7.215	0.0001
DETERMSQ	1	0.012113	0.00558334	2.170	0.0300
OBLIS	1	1.514788	0.86079436	1.760	0.0785
SINGLEPL	1	0.075563	0.59613212	0.127	0.8991
MARRPL	1	-1.174207	0.25471343	-4.610	0.0001
E4	1	0.902904	0.00475908	189.722	0.0001
MINORITY	1	2.649189	0.15126286	17.514	0.0001

Durbin-Watson D	1.995
(For Number of Obs.)	74625
1st Order Autocorrelation	0.003

Model: MODEL6
Dependent Variable: NEWTTOE6

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	17	6148604.7367	361682.63157	761.634	0.0001
Error	57496	27303549.582	474.87737551		
C Total	57513	33452154.319			

Root MSE	21.79168	R-square	0.1838
Dep Mean	76.49823	Adj R-sq	0.1836
C.V.	28.48652		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	60.665425	1.95939095	30.961	0.0001
FISCAL79	1	13.518192	0.24967484	54.143	0.0001
FISCAL82	1	9.900568	0.24502153	40.407	0.0001
AGESQ	1	-0.003541	0.00624679	-0.567	0.5708
SEX	1	3.264242	0.30027631	10.871	0.0001
AFQT1	1	-2.323573	0.24802836	-9.368	0.0001
AFQT4	1	3.568982	0.36163741	9.869	0.0001
DEP	1	-0.596549	0.52283247	-1.141	0.2539
ENTRGRAD	1	-0.987682	0.12219467	-8.083	0.0001
HIYREDUC	1	-2.576137	0.52196674	-4.935	0.0001
HIYREDSQ	1	0.146783	0.02266867	6.475	0.0001
DETERMSQ	1	0.010967	0.00906864	1.209	0.2265
OBLIS	1	0.709126	1.42234190	0.499	0.6181
SINGLEPL	1	-0.532059	0.96194010	-0.553	0.5802
MARRPL	1	1.698619	0.42081948	4.036	0.0001
E4	1	-0.186706	0.00975567	-19.138	0.0001
E5	1	0.435687	0.00647698	67.267	0.0001
MINORITY	1	5.795511	0.25995572	22.294	0.0001

Durbin-Watson D	1.996
(For Number of Obs.)	57514
1st Order Autocorrelation	0.002

Model: MODEL7
DEPENDENT VARIABLE: NEWTTOE4 (COHORT 79)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	12	2714694.4709	226224.53924	1167.983	0.0001
Error	50782	9835871.9649	193.68815653		
C Total	50794	12550566.436			

Root MSE	13.91719	R-square	0.2163
Dep Mean	27.69168	Adj R-sq	0.2161
C.V.	50.25765		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	58.554079	1.10712170	52.889	0.0001
AGESQ	1	0.004686	0.00481178	0.974	0.3302
SEX	1	-2.467084	0.19692267	-12.528	0.0001
AFQT1	1	-2.792464	0.15749259	-17.731	0.0001
AFQT4	1	2.185068	0.18529324	11.792	0.0001
ENTRGRAD	1	-6.554987	0.08128244	-80.645	0.0001
HIYREDUC	1	-4.437679	0.32742072	-13.553	0.0001
HIYREDSQ	1	0.246476	0.01299345	18.969	0.0001
DETERMSQ	1	-0.009427	0.00706050	-1.335	0.1818
OBLIS	1	-1.689876	0.70986866	-2.381	0.0173
SINGLEPL	1	-0.189316	1.20640680	-0.157	0.8753
MARRPL	1	-1.642574	0.55557695	-2.957	0.0031
MINORITY	1	1.678688	0.15919779	10.545	0.0001

Model: MODEL8
DEPENDENT VARIABLE: NEWTTOE4 (COHORT 82)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	12	3479043.7647	289920.31373	1506.222	0.0001
Error	54461	10482747.591	192.48173173		
C Total	54473	13961791.356			

Root MSE	13.87378	R-square	0.2492
Dep Mean	28.70138	Adj R-sq	0.2490
C.V.	48.33837		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	50.936307	1.04236299	48.866	0.0001
AGESQ	1	-0.000882	0.00348584	-0.253	0.8003
SEX	1	-0.263105	0.19186935	-1.371	0.1703
AFQT1	1	-3.734884	0.14513157	-25.734	0.0001
AFQT4	1	2.184874	0.20745839	10.532	0.0001
ENTRGRAD	1	-7.240272	0.07730145	-93.663	0.0001
HIYREDUC	1	-2.153021	0.29396609	-7.324	0.0001
HIYREDSQ	1	0.125586	0.01312793	9.566	0.0001
DETERMSQ	1	-0.002186	0.00508093	-0.430	0.6670
OBLIS	1	0.147067	1.07532438	0.137	0.8912
SINGLEPL	1	-1.009959	0.53768405	-1.878	0.0603
MARRPL	1	-2.431179	0.25333068	-9.597	0.0001
MINORITY	1	2.306943	0.16066965	14.358	0.0001

Model: MODEL9
DEPENDENT VARIABLE: NEWTTOE4 (COHORT 85)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	12	2628864.1984	219072.01654	1308.999	0.0001
Error	58876	9853392.4338	167.35838769		
C Total	58888	12482256.632			

Root MSE	12.93671	R-square	0.2106
Dep Mean	27.21362	Adj R-sq	0.2104
C.V.	47.53762		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	55.194365	1.30881970	42.171	0.0001
AGESQ	1	0.017407	0.00417033	4.174	0.0001
SEX	1	3.099319	0.16625111	18.642	0.0001
AFQT1	1	-6.713188	0.12903642	-52.026	0.0001
AFQT4	1	2.226526	0.20173861	11.037	0.0001
ENTRGRAD	1	-5.250546	0.07674972	-68.411	0.0001
HIYREDUC	1	-5.296478	0.36627939	-14.460	0.0001
HIYREDSQ	1	0.270732	0.01611438	16.801	0.0001
DETERMSQ	1	-0.028341	0.00594166	-4.770	0.0001
OBLIS	1	0.417699	0.88401091	0.473	0.6366
SINGLEPL	1	-2.573809	0.57072974	-4.510	0.0001
MARRPL	1	-2.381132	0.23621230	-10.080	0.0001
MINORITY	1	2.525669	0.13319517	18.962	0.0001

Model: MODEL10
Dependent Variable: NEWTTOE5 (COHORT 79)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	12	2088309.8489	174025.82074	359.971	0.0001
Error	26149	12641564.462	483.44351455		
C Total	26161	14729874.311			

Root MSE	21.98735	R-square	0.1418
Dep Mean	46.65740	Adj R-sq	0.1414
C.V.	47.12510		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	86.717359	2.70755172	32.028	0.0001
AGESQ	1	0.014000	0.01082811	1.293	0.1961
SEX	1	-1.124941	0.43192150	-2.605	0.0092
AFQT1	1	-5.300676	0.36349360	-14.583	0.0001
AFQT4	1	5.785940	0.44545710	12.989	0.0001
ENTRGRAD	1	-5.430791	0.16865339	-32.201	0.0001
HIYREDUC	1	-6.931458	0.78925016	-8.782	0.0001
HIYREDSQ	1	0.361717	0.03221862	11.227	0.0001
DETERMSQ	1	-0.027497	0.01586816	-1.733	0.0831
OBLIS	1	3.312905	1.73475916	1.910	0.0562
SINGLEPL	1	2.631334	2.54931955	1.032	0.3020
MARRPL	1	-2.852717	1.06710941	-2.673	0.0075
MINORITY	1	3.689778	0.36020841	10.243	0.0001

Model: MODEL11
Dependent Variable: NEWTTOE5 (COHORT 82)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	12	1979792.0054	164982.66711	463.952	0.0001
Error	27066	9624755.2622	355.60316494		
C Total	27078	11604547.268			

Root MSE	18.85744	R-square	0.1706
Dep Mean	47.21832	Adj R-sq	0.1702
C.V.	39.93671		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	73.613585	2.23717734	32.905	0.0001
AGESQ	1	-0.006462	0.00698595	-0.925	0.3550
SEX	1	2.400825	0.38170442	6.290	0.0001
AFQT1	1	-6.917715	0.30040880	-23.028	0.0001
AFQT4	1	7.075638	0.45951360	15.398	0.0001
ENTRGRAD	1	-4.329440	0.13984573	-30.959	0.0001
HIYREDUC	1	-3.798901	0.62635653	-6.065	0.0001
HIYREDSQ	1	0.210331	0.02807912	7.491	0.0001
DETERMSQ	1	-0.001311	0.01013627	-0.129	0.8971
OBLIS	1	1.068694	2.15229512	0.497	0.6195
SINGLEPL	1	-0.596021	1.00017721	-0.596	0.5512
MARRPL	1	-2.700546	0.44608460	-6.054	0.0001
MINORITY	1	5.108786	0.32320527	15.807	0.0001

Model: MODEL12
Dependent Variable: NEWTTOE5 (COHORT 85)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	12	808595.33818	67382.94485	320.677	0.0001
Error	25287	5313486.043	210.12718167		
C Total	25299	6122081.3812			

Root MSE	14.49576	R-square	0.1321
Dep Mean	45.22198	Adj R-sq	0.1317
C.V.	32.05469		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	69.805953	2.36945736	29.461	0.0001
AGESQ	1	0.000478	0.00700281	0.068	0.9456
SEX	1	5.034292	0.30605219	16.449	0.0001
AFQT1	1	-7.352252	0.24311410	-30.242	0.0001
AFQT4	1	3.862167	0.42755377	9.033	0.0001
ENTRGRAD	1	-1.542907	0.11841970	-13.029	0.0001
HIYREDUC	1	-5.189953	0.65801593	-7.887	0.0001
HIYREDSQ	1	0.275719	0.02906786	9.485	0.0001
DETERMSQ	1	-0.010493	0.00993927	-1.056	0.2911
OBLIS	1	-0.362767	1.43854440	-0.252	0.8009
SINGLEPL	1	-1.975986	0.89445661	-2.209	0.0272
MARRPL	1	-2.579464	0.36339676	-7.098	0.0001
MINORITY	1	3.973183	0.24187954	16.426	0.0001

Model: MODEL13
Dependent Variable: NEWTTOE6 (COHORT 79)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	12	1577046.8551	131420.57125	187.463	0.0001
Error	23444	16435338.182	701.04667216		
C Total	23456	18012385.037			

Root MSE	26.47729	R-square	0.0876
Dep Mean	81.35887	Adj R-sq	0.0871
C.V.	32.54382		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	100.622181	3.47475190	28.958	0.0001
AGESQ	1	-0.032738	0.01381359	-2.370	0.0178
SEX	1	2.613978	0.54449286	4.801	0.0001
AFQT1	1	-5.287538	0.46080858	-11.474	0.0001
AFQT4	1	5.840278	0.58341687	10.010	0.0001
ENTRGRAD	1	-2.920620	0.21256098	-13.740	0.0001
HIYREDUC	1	-3.852935	1.01178548	-3.808	0.0001
HIYREDSQ	1	0.269231	0.04137534	6.507	0.0001
DETERMSQ	1	0.050345	0.02024696	2.487	0.0129
OBLIS	1	1.025955	2.26323606	0.453	0.6503
SINGLEPL	1	2.220348	3.31861706	0.669	0.5035
MARRPL	1	-1.718147	1.36762982	-1.256	0.2090
MINORITY	1	9.047602	0.46785494	19.338	0.0001

Model: MODEL14
Dependent Variable: NEWTTOE6 (COHORT 82)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	12	545487.16806	45457.26400	92.402	0.0001
Error	23128	11377789.398	491.94869412		
C Total	23140	11923276.566			

Root MSE	22.17992	R-square	0.0457
Dep Mean	76.83959	Adj R-sq	0.0453
C.V.	28.86522		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	95.037302	2.85613267	33.275	0.0001
AGESQ	1	-0.002984	0.00891713	-0.335	0.7379
SEX	1	4.956897	0.49184949	10.078	0.0001
AFQT1	1	-4.408320	0.38860381	-11.344	0.0001
AFQT4	1	2.414100	0.64285974	3.755	0.0002
ENTRGRAD	1	-1.072026	0.17546848	-6.110	0.0001
HIYREDUC	1	-4.731868	0.80116370	-5.906	0.0001
HIYREDSQ	1	0.255014	0.03582005	7.119	0.0001
DETERMSQ	1	0.002961	0.01296250	0.228	0.8193
OBLIS	1	-3.022658	2.71387589	-1.114	0.2654
SINGLEPL	1	-1.621578	1.25795097	-1.289	0.1974
MARRPL	1	1.607673	0.56656825	2.838	0.0045
MINORITY	1	6.760341	0.43512038	15.537	0.0001

Model: MODEL15
Dependent Variable: NEWTTOE6 (COHORT 85)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	12	30730.21120	2560.85093	12.363	0.0001
Error	14492	3001866.8549	207.13958425		
C Total	14504	3032597.0661			

Root MSE	14.39234	R-square	0.0101
Dep Mean	65.72727	Adj R-sq	0.0093
C.V.	21.89707		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	57.149615	3.19667408	17.878	0.0001
AGESQ	1	-0.026581	0.00943128	-2.818	0.0048
SEX	1	2.553184	0.44855483	5.692	0.0001
AFQT1	1	1.723023	0.35918558	4.797	0.0001
AFQT4	1	-1.693743	0.72982555	-2.321	0.0203
ENTRGRAD	1	0.768655	0.14566299	5.277	0.0001
HIYREDUC	1	1.332867	0.88731968	1.502	0.1331
HIYREDSQ	1	-0.040222	0.03880771	-1.036	0.3000
DETERMSQ	1	0.036149	0.01343064	2.692	0.0071
OBLIS	1	2.594385	2.10343116	1.233	0.2174
SINGLEPL	1	1.761290	1.13190885	1.556	0.1197
MARRPL	1	-0.069699	0.47583468	-0.146	0.8835
MINORITY	1	1.794431	0.36716698	4.887	0.0001

Model: MODEL16
DEPENDENT VARIABLE: NEWTTOE4 (COHORT 79)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	18	2724705.0357	151372.50198	782.231	0.0001
Error	50776	9825861.4	193.51389239		
C Total	50794	12550566.436			

Root MSE	13.91093	R-square	0.2171
Dep Mean	27.69168	Adj R-sq	0.2168
C.V.	50.23504		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	58.469049	1.10751540	52.793	0.0001
AGESQ	1	0.004065	0.00481101	0.845	0.3982
SEX	1	-2.516764	0.19696578	-12.778	0.0001
AFQT1	1	-2.764498	0.15753265	-17.549	0.0001
AFQT4	1	2.133461	0.18542628	11.506	0.0001
ENTRGRAD	1	-6.571002	0.08127527	-80.849	0.0001
HIYREDUC	1	-4.402406	0.32744112	-13.445	0.0001
HIYREDSQ	1	0.245921	0.01299231	18.928	0.0001
DETERMSQ	1	-0.008255	0.00706177	-1.169	0.2424
OBLIS	1	-1.693234	0.70961531	-2.386	0.0170
SINGLEPL	1	-0.317361	1.20600358	-0.263	0.7924
MARRPL	1	-1.625336	0.55537741	-2.927	0.0034
BLACK	1	2.211164	0.18068253	12.238	0.0001
HISPANIC	1	0.383734	0.39681727	0.967	0.3335
OHISP	1	-0.227732	0.91953953	-0.248	0.8044
MEXICAN	1	-0.002448	0.52791499	-0.005	0.9963
PUERTRI	1	0.823666	0.72195189	1.141	0.2539
FILIPIN	1	-1.692225	0.82480138	-2.052	0.0402
NATIND	1	4.492823	2.07518266	2.165	0.0304

Model: MODEL17
DEPENDENT VARIABLE: NEWTTOE4 (COHORT 82)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	18	3485898.3178	193661.01765	1006.674	0.0001
Error	54455	10475893.038	192.37706434		
C Total	54473	13961791.356			

Root MSE	13.87001	R-square	0.2497
Dep Mean	28.70138	Adj R-sq	0.2494
C.V.	48.32522		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	50.911734	1.04236550	48.842	0.0001
AGESQ	1	-0.000692	0.00348623	-0.198	0.8428
SEX	1	-0.290262	0.19190739	-1.513	0.1304
AFQT1	1	-3.709018	0.14522385	-25.540	0.0001
AFQT4	1	2.168522	0.20743147	10.454	0.0001
ENTRGRAD	1	-7.252526	0.07736402	-93.745	0.0001
HIYREDUC	1	-2.155811	0.29391994	-7.335	0.0001
HIYREDSQ	1	0.125878	0.01312621	9.590	0.0001
DETERMSQ	1	-0.002234	0.00508053	-0.440	0.6601
OBLIS	1	0.139562	1.07510169	0.130	0.8967
SINGLEPL	1	-1.085367	0.53773925	-2.018	0.0436
MARRPL	1	-2.397490	0.25334377	-9.463	0.0001
BLACK	1	2.700553	0.18159640	14.871	0.0001
HISPANIC	1	0.351264	1.15023371	0.305	0.7601
OHISP	1	1.512815	1.42150103	1.064	0.2872
MEXICAN	1	0.943340	1.23056629	0.767	0.4433
PUERTRI	1	1.855892	1.31293057	1.414	0.1575
FILIPIN	1	-0.341142	0.70003238	-0.487	0.6260
NATIND	1	3.240728	1.10219139	2.940	0.0033

Model: MODEL18
DEPENDENT VARIABLE: NEWTTOE4 (COHORT 85)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	18	2635243.305	146402.40583	875.261	0.0001
Error	58870	9847013.3273	167.26708557		
C Total	58888	12482256.632			

Root MSE	12.93318	R-square	0.2111
Dep Mean	27.21362	Adj R-sq	0.2109
C.V.	47.52465		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	55.043025	1.30919074	42.044	0.0001
AGESQ	1	0.017318	0.00416948	4.153	0.0001
SEX	1	3.057923	0.16650710	18.365	0.0001
AFQT1	1	-6.678578	0.12929865	-51.652	0.0001
AFQT4	1	2.179632	0.20215602	10.782	0.0001
ENTRGRAD	1	-5.271707	0.07686842	-68.581	0.0001
HIYREDUC	1	-5.265314	0.36629199	-14.375	0.0001
HIYREDSQ	1	0.269691	0.01611635	16.734	0.0001
DETERMSQ	1	-0.027819	0.00594119	-4.682	0.0001
OBLIS	1	0.403733	0.88382231	0.457	0.6478
SINGLEPL	1	-2.653978	0.57078432	-4.650	0.0001
MARRPL	1	-2.360744	0.23619038	-9.995	0.0001
BLACK	1	2.835600	0.15547157	18.239	0.0001
HISPANIC	1	2.339705	0.76722966	3.050	0.0023
OHISP	1	-0.938435	0.94932548	-0.989	0.3229
MEXICAN	1	-0.111672	0.83720790	-0.133	0.8939
PUERTRI	1	0.957110	0.89765149	1.066	0.2863
FILIPIN	1	1.233787	0.51980057	2.374	0.0176
NATIND	1	1.903776	0.91923897	2.071	0.0384

Model: MODEL19
Dependent Variable: NEWTTOE5 (COHORT 79)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	18	2095003.6864	116389.09369	240.822	0.0001
Error	26143	12634870.624	483.29842116		
C Total	26161	14729874.311			

Root MSE	21.98405	R-square	0.1422
Dep Mean	46.65740	Adj R-sq	0.1416
C.V.	47.11803		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	86.924955	2.71063240	32.068	0.0001
AGESQ	1	0.013997	0.01083583	1.292	0.1965
SEX	1	-1.143214	0.43253583	-2.643	0.0082
AFQT1	1	-5.253963	0.36389397	-14.438	0.0001
AFQT4	1	5.702993	0.44619660	12.781	0.0001
ENTRGRAD	1	-5.435980	0.16873966	-32.215	0.0001
HIYREDUC	1	-6.971661	0.78983114	-8.827	0.0001
HIYREDSQ	1	0.364076	0.03223189	11.296	0.0001
DETERMSQ	1	-0.027636	0.01588886	-1.739	0.0820
OBLIS	1	3.227025	1.73486619	1.860	0.0629
SINGLEPL	1	2.512191	2.54942905	0.985	0.3244
MARRPL	1	-2.833963	1.06718825	-2.656	0.0079
BLACK	1	4.215928	0.40909305	10.306	0.0001
HISPANIC	1	1.518563	0.92899764	1.635	0.1021
OHISP	1	2.673695	2.18996047	1.221	0.2221
MEXICAN	1	0.508946	1.22512492	0.415	0.6778
PUERTRI	1	2.882234	1.55929796	1.848	0.0646
FILIPIN	1	4.750595	1.53827945	3.088	0.0020
NATIND	1	-4.504536	5.50192307	-0.819	0.4130

Model: MODEL20
Dependent Variable: NEWTTOE5 (COHORT 82)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	18	1982136.0053	110118.66696	309.674	0.0001
Error	27060	9622411.2622	355.59539033		
C Total	27078	11604547.268			

Root MSE	18.85724	R-square	0.1708
Dep Mean	47.21832	Adj R-sq	0.1703
C.V.	39.93627		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	73.636912	2.23804732	32.902	0.0001
AGESQ	1	-0.006419	0.00699236	-0.918	0.3586
SEX	1	2.400594	0.38210656	6.283	0.0001
AFQT1	1	-6.884889	0.30084714	-22.885	0.0001
AFQT4	1	7.085261	0.45938576	15.423	0.0001
ENTRGRAD	1	-4.326250	0.14010790	-30.878	0.0001
HIYREDUC	1	-3.817223	0.62650401	-6.093	0.0001
HIYREDSQ	1	0.211527	0.02808657	7.531	0.0001
DETERMSQ	1	-0.001234	0.01014082	-0.122	0.9032
OBLIS	1	0.998419	2.15237530	0.464	0.6427
SINGLEPL	1	-0.673454	1.00086328	-0.673	0.5010
MARRPL	1	-2.665627	0.44626818	-5.973	0.0001
BLACK	1	5.502557	0.36771451	14.964	0.0001
HISPANIC	1	1.262055	2.45920799	0.513	0.6078
OHISP	1	3.285022	3.10857567	1.057	0.2906
MEXICAN	1	3.150102	2.62462635	1.200	0.2301
PUERTRI	1	3.500307	2.75138804	1.272	0.2033
FILIPIN	1	4.388986	1.19723179	3.666	0.0002
NATIND	1	3.368637	2.18153848	1.544	0.1226

Model: MODEL21
Dependent Variable: NEWTTOE5 (COHORT 85)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	18	810298.64177	45016.59121	214.253	0.0001
Error	25281	5311782.7394	210.10967681		
C Total	25299	6122081.3812			

Root MSE	14.49516	R-square	0.1324
Dep Mean	45.22198	Adj R-sq	0.1317
C.V.	32.05335		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	69.815849	2.37074435	29.449	0.0001
AGESQ	1	0.000491	0.00700336	0.070	0.9442
SEX	1	4.983630	0.30707352	16.229	0.0001
AFQT1	1	-7.309966	0.24387793	-29.974	0.0001
AFQT4	1	3.904856	0.42857629	9.111	0.0001
ENTRGRAD	1	-1.551348	0.11862249	-13.078	0.0001
HIYREDUC	1	-5.187216	0.65826016	-7.880	0.0001
HIYREDSQ	1	0.275912	0.02908001	9.488	0.0001
DETERMSQ	1	-0.010294	0.00994101	-1.036	0.3004
OBLIS	1	-0.383894	1.43893980	-0.267	0.7896
SINGLEPL	1	-1.982615	0.89501623	-2.215	0.0268
MARRPL	1	-2.573767	0.36344981	-7.081	0.0001
BLACK	1	4.318153	0.28779651	15.004	0.0001
HISPANIC	1	1.618237	1.48311198	1.091	0.2752
OHISP	1	0.746477	1.79593959	0.416	0.6777
MEXICAN	1	1.654104	1.60457437	1.031	0.3026
PUERTRI	1	2.088947	1.69784144	1.230	0.2186
FILIPIN	1	5.009150	0.80657266	6.210	0.0001
NATIND	1	0.612095	1.74898280	0.350	0.7264

Model: MODEL22
Dependent Variable: NEWTTOE6 (COHORT 79)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	18	1620119.954	90006.66411	128.693	0.0001
Error	23438	16392265.083	699.38838993		
C Total	23456	18012385.037			

Root MSE	26.44595	R-square	0.0899
Dep Mean	81.35887	Adj R-sq	0.0892
C.V.	32.50531		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	101.787362	3.47511269	29.290	0.0001
AGESQ	1	-0.030940	0.01380853	-2.241	0.0251
SEX	1	2.614431	0.54473403	4.799	0.0001
AFQT1	1	-5.209348	0.46089497	-11.303	0.0001
AFQT4	1	5.622890	0.58402063	9.628	0.0001
ENTRGRAD	1	-2.903305	0.21246337	-13.665	0.0001
HIYREDUC	1	-4.094166	1.01148489	-4.048	0.0001
HIYREDSQ	1	0.279016	0.04135219	6.747	0.0001
DETERMSQ	1	0.046183	0.02025246	2.280	0.0226
OBLIS	1	0.736609	2.26096445	0.326	0.7446
SINGLEPL	1	2.156641	3.31524125	0.651	0.5154
MARRPL	1	-1.599016	1.36646172	-1.170	0.2419
BLACK	1	10.117809	0.53815908	18.801	0.0001
HISPANIC	1	2.206801	1.19161758	1.852	0.0640
OHISP	1	7.489435	2.79876905	2.676	0.0075
MEXICAN	1	2.085939	1.57287623	1.326	0.1848
PUERTRI	1	6.160490	2.04479817	3.013	0.0026
FILIPIN	1	19.075752	1.99931012	9.541	0.0001
NATIND	1	-5.929259	6.61877632	-0.896	0.3704

Model: MODEL23
Dependent Variable: NEWTTOE6 (COHORT 82)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	18	557279.86568	30959.99254	62.982	0.0001
Error	23122	11365996.7	491.56633077		
C Total	23140	11923276.566			

Root MSE	22.17130	R-square	0.0467
Dep Mean	76.83959	Adj R-sq	0.0460
C.V.	28.85400		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	95.310822	2.85650819	33.366	0.0001
AGESQ	1	-0.003960	0.00892018	-0.444	0.6571
SEX	1	4.965352	0.49204620	10.091	0.0001
AFQT1	1	-4.350976	0.38899812	-11.185	0.0001
AFQT4	1	2.402283	0.64252633	3.739	0.0002
ENTRGRAD	1	-1.028276	0.17574188	-5.851	0.0001
HIYREDUC	1	-4.784594	0.80108167	-5.973	0.0001
HIYREDSQ	1	0.258884	0.03582054	7.227	0.0001
DETERMSQ	1	0.004044	0.01296278	0.312	0.7551
OBLIS	1	-3.229699	2.71296459	-1.190	0.2339
SINGLEPL	1	-1.580203	1.25809933	-1.256	0.2091
MARRPL	1	1.660022	0.56651990	2.930	0.0034
BLACK	1	7.649706	0.50732693	15.078	0.0001
HISPANIC	1	10.223915	3.17298914	3.222	0.0013
OHISP	1	-9.211018	4.00461621	-2.300	0.0215
MEXICAN	1	-8.000040	3.38845289	-2.361	0.0182
PUERTRI	1	-6.943606	3.56236951	-1.949	0.0513
FILIPIN	1	10.185705	1.64196451	6.203	0.0001
NATIND	1	0.278662	2.82122358	0.099	0.9213

Model: MODEL24
Dependent Variable: NEWTTOE6 (COHORT 85)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	18	40232.22258	2235.12348	10.820	0.0001
Error	14486	2992364.8435	206.56943556		
C Total	14504	3032597.0661			

Root MSE	14.37252	R-square	0.0133
Dep Mean	65.72727	Adj R-sq	0.0120
C.V.	21.86691		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	57.269258	3.19446126	17.928	0.0001
AGESQ	1	-0.027460	0.00942307	-2.914	0.0036
SEX	1	2.574436	0.44862599	5.738	0.0001
AFQT1	1	1.883401	0.35985781	5.234	0.0001
AFQT4	1	-1.577712	0.73020521	-2.161	0.0307
ENTRGRAD	1	0.774260	0.14557445	5.319	0.0001
HIYREDUC	1	1.316920	0.88664253	1.485	0.1375
HIYREDSQ	1	-0.038203	0.03877489	-0.985	0.3245
DETERMSQ	1	0.036661	0.01341907	2.732	0.0063
OBLIS	1	2.718129	2.10136588	1.294	0.1959
SINGLEPL	1	1.923638	1.13089079	1.701	0.0890
MARRPL	1	-0.048768	0.47520310	-0.103	0.9183
BLACK	1	2.254761	0.47373394	4.760	0.0001
HISPANIC	1	2.354273	1.89207845	1.244	0.2134
OHISP	1	-3.597440	2.32976745	-1.544	0.1226
MEXICAN	1	-2.863159	2.08539485	-1.373	0.1698
PUERTRI	1	-0.039018	2.32780129	-0.017	0.9866
FILIPIN	1	8.264582	1.38595286	5.963	0.0001
NATIND	1	-7.048053	2.43367992	-2.896	0.0038

APPENDIX D. LIST OF VARIABLE NAMES

Male	Gender of sailor
E-1	Entry grade at enlistment is E-1
E-2	Entry grade at enlistment is E-2
E-3	Entry grade at enlistment is E-3
Still active	Sailor is still serving in 1992
TTOE4	Time in service to promotion to E-4 in months
TTOE5	Time in service to promotion to E-5 in months
TTOE6	Time in service to promotion to E-6 in months
Entry age	Age at enlistment
AFQT score	Score on the AFQT
AFQT 1	AFQT score above average
AFQT 4	AFQT score below average
TINSVC	Time in service at discharge in months
Education	Level of education as in Table III
Fiscal 1979	Dummy variable for the 1979 Navy enlisted personnel cohort
Fiscal 1982	Dummy variable for the 1982 Navy enlisted personnel cohort
Fiscal 1985	Dummy variable for the 1985 Navy enlisted personnel cohort
Gender	Dummy variable for gender (female = 1)
DEP	Delayed Entry Program (dummy variable, participation = 1)
Determination	Subtracts educational level from age
Short Obligation	InitiaL term is less or equal to three years (dummy variable, yes = 1)
Single	Single with children (dummy variable, yes = 1)
Married	Married with children (dummy variable, yes = 1)
Minority	Racial/ethnic minority (dummy variable, yes = 1)
Black	Blacks (dummy variable, yes = 1)
Hispanic	Hispanic (dummy variable, yes = 1)
Mexican-American	Mexican Americans (dummy variable, yes = 1)
Puerto Rican	Puerto Ricans (dummy variable, yes = 1)
Philippine	Filipino-Americans (dummy variable, yes = 1)
Native Indian	Native Indian American (dummy variable, yes = 1)

LIST OF REFERENCES

Butler, J.S., Inequality in the Military: An Examination of Promotion Time for Black and White Enlisted Men, American Sociological Review, vol. 41, 1976.

Buddin, R. Analysis of Early Military Attrition Behavior, Rand Corporation, Santa Monica, CA, 1984.

Cooke, T.W., and Quester, A.O., What Characterizes Successful Enlistees in the All Volunteer Force, Social Science Quarterly, vol.73, pp. 238 - 252, 1992.

Dye, G.B., An Alternative Approach for Measuring Black Representation in Navy Enlisted Occupations, Master's Thesis, Naval Postgraduate School, Monterey, CA, 1994.

Eitelberg, M.J., Manpower for Military Occupations, Office of the Assistant Secretary of Defense (Force Management and Personnel), 1988.

Eitelberg, M.J. and Mehay, S.L., Demographics and the American Military at the End of the Twentieth Century, in U.S. Domestic and National Security Agendas: Into the Twenty-first Century, Sarkesian, S.C. and Flanagin, J.M., Greenwood Press, pp. 82-100, 1994.

Gilroy, C.L., Horne, D.K. and Smith D.A., Military Compensation and Personnel Retention, Models and Evidence, United States Army Research Institute for the Behavioral and Social Sciences, 1991.

Gujarati, D.N., Basic Econometrics, McGraw-Hill, Inc., 1988.

Henderson, D.R., The Fortune Encyclopedia of Economics, Warner Books, 1993.

Horne, D.K., The Impact of Soldier Quality on Army Performance, Armed Forces & Society, vol.13, pp. 443 - 455, 1987.

Kearl, C.E. and Nelson, A., The Army's Delayed Entry Program, Armed Forces & Society, vol.18, pp. 253 - 268, 1992.

Mehay, S.L., The Decision to Accept a Separation Bonus: The Case of Military Personnel, Proceedings of Industrial Relations Research Association, 1995.

Robinson C.A. and Prevetta, S.S., Disparities in Minority Promotion Rates: A Total Quality Approach, Fiscal Years 1987-1991, Defense Equal Opportunity Management Institute, 1992.

Secretary of the Navy, Equal Opportunity (EO) WITHIN THE DEPARTMENT OF THE NAVY, SECNAVINST 5350.10B, Department of the Navy, 1989.

Zucca, G.J., Ethnic Distribution Among U.S. Navy Occupation Specialties and Ranks: Organizational Implications, Ph.D. Dissertation, University of Florida, 1984.

Zucca, G.J. and Gorman, B., Affirmative Action: Blacks And Hispanics in U.S. Navy Occupational Specialties, Armed Forces & Society, vol.12, pp. 513 - 524, 1986.

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